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PUBLIC WORKS

CITY COUNTY STATE

MAKING A ROCK CUT FOR RELOCATING TRACKS OF THE ERIE AND BIG FOUR RAILROADS AROUND HUFFMAN DAM, OHIO

Shows how the rock was blasted in a long windrow ahead of the steam shovel, the latter then following and loading the shattered material into the cars.

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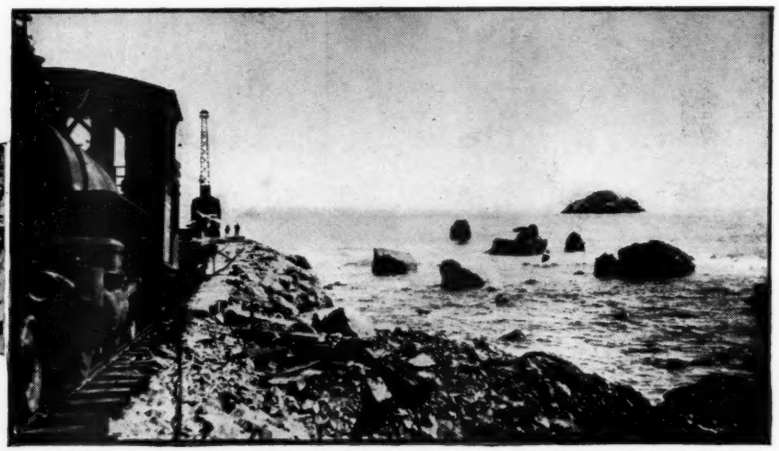
APRIL 2, 1921

2-TON TUNNEL CAR WITH ROLLER BEARING WHEELS

engineering practice at Reno, Nevada.



Hercules Service On A Difficult Job

The blasting of "Lovers' Rock" at Crescent City, California, was a difficult job which Hercules Explosives and Service helped to perform successfully.

"Lovers' Rock" was 200 feet long, 150 feet wide, 85 feet high, and was tied to the coast line at one point, 100 feet wide. The contract stipulated 30% of 10-ton rock and 40% of 20-ton rock. The broken rock was used for building a jetty and small pieces were not desired.

A tunnel was driven 75 feet into the rock, and a 20-foot cross-cut turned off at 55 feet from the entrance. A second cross-cut was driven at 75-feet large enough to hold 5,500 pounds of Hercules Black Blasting Powder. Two thousand pounds of the same brand were placed in the first cross-cut and the tunnel back-filled with rock.

After the blast, Mr. Wm. B. Arndt, the contractor, wrote us as follows: "I beg to advise that the shooting of Lovers' Rock was very successful. It was an extremely difficult shot, for the reason that it was facing the water on three sides and, if it had broken out at any point other than the one desired, it would have made expensive handling. Your representative not only placed the rock exactly where wanted, but broke it in the dimensions required."

Put *your* blasting problems up to the Hercules Service Division.

HERCULES POWDER CO.

Chicago	Salt Lake City	Chattanooga	Hazleton, Pa.
Pittsburg, Kan.	Pittsburgh, Pa.	St. Louis	Joplin
San Francisco	New York	Denver	Wilmington, Del.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

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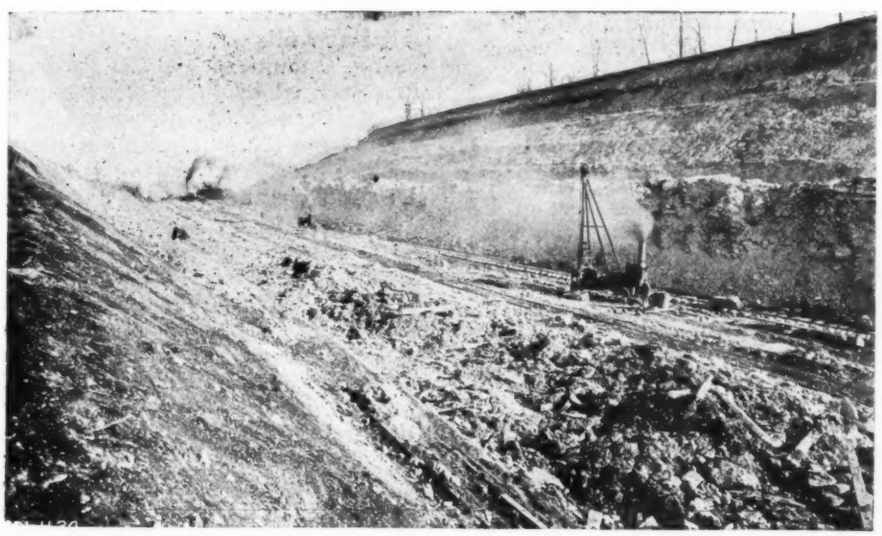
Costly Railroad Re-location

Shifting 15 miles of double-track railroad around Huffman dam, Miami Conservancy District, required excavating 657,000 yards, mostly rock in one cut 120 feet deep, placing 390,000 yards of embankment, cost more than $3,237,000.



SHOWS THE FULL SCOPE OF THE WORK OF EXCAVATION, WITH TWO WELL DRILLS IN THE FOREGROUND AND THE STEAM SHOVEL, DUMP CAR TRAIN AND INGERSOLL ROCK DRILLS IN THE BACKGROUND.

The $25,000,000 flood protection works in the Miami valley, Ohio, that are now in an advanced stage of construction by the Miami Conservancy Commission, include the Huffman dam, an earth embankment 65 feet high, 3,340 feet long and nearly 400 feet wide at the base, which contains 1,547,000 yards of earth and, impounding the drainage area of 671 square miles, forms a retarding basin that has, in a flood like the disastrous one of 1913, a submerged area of 7,300 acres and retains 124,000 acre-feet of water with an average maximum depth of 17 feet and a possible maximum depth much greater.

The dam is built across the valley of the Miami river at a point about 6 miles above the city of Dayton and at a point where there were located the two double tracks of the Erie and Big Four Railroads at an elevation about 60 feet below the top of the dam.

DIVERSION AND ELEVATION OF TRACKS

Both roads have large and costly yards in Dayton, the elevations of which could not be changed, and as the greatest permissible grades from these yards would not bring the track level within 35 feet of the top of the dam at the dam site it was necessary to divert the alignment of both roads to a point beyond the end of the dam. This necessitated a long, deep cut through the rocky hillside, beyond which the still ascending tracks continued for a long distance, below the level of the flow line in the reservoir, making it necessary to protect the tracks by very heavy levees on both sides to exclude, in time of flood, the water that will then fill the basin through which the tracks pass.

The two double-track systems are combined to form a single four-track system for the purposes of re-location, and were built 14 feet apart on

centers for the first 7 miles from Dayton to a point a mile beyond the dam, where the distance between tracks is increased to 60 feet to the end of the re-location, which is about 15.22 miles long. The tracks are run on a grade of 0.3 per cent to a point in the retarding basin beyond the dam, where they reach the elevation of the flow line. The new location is nearly 8,000 feet longer than the original location of the two double-track systems, and it also involves an increase of 93 degrees in curvature and a considerable increase in grades, which with operating expenses, together with some other items of maintenance, are capitalized at $579,974. This sum added to $2,717,120, makes a total charge to the Conservancy District of $3,237,094, exclusive of the cost of right-of-way amounting to 345 acres.

HUFFMAN DAM CUT

The principal feature of the re-location is the deep cut in which the tracks pass about 400 feet south of the south end of the dam and at an elevation 35 feet below its crest. This involves a rock cut 120 feet in maximum depth, 4,500 feet long, 72 feet wide at the bottom and very much wider at the top, where about 54,000 yards of earth were excavated. The remaining 593,000 yards of spoil was rock, consisting of a 35-foot stratum of Brassfield formation, 44 feet of Elkhorn and 41 feet of Cincinnatian formation.

All of the rock was drilled by five Ingersoll-Rand E-44 steam drills, four well drills and two jackhammer drills. The rock drills averaged 60 to 65 feet of 3¼ to 3½-inch holes in each 10-hour shift. The well drills averaged to 40 to 50 feet in 10 hours. About 90 per cent of the holes were sprung and then charged with from 100 to 250 pounds of 45 per cent Du Pont or Aetna dynamite, which was used after so many springs had been encountered that the original use of ammonia dynamite was superseded.

The Brassfield stratum was sufficiently solid to be excavated on a 1:1 slope with a 8-foot berm at the foot. The Elkhorn stratum, which is much softer, was greasy and was excavated on a 1½:1 slope, with a 4-foot berm at the foot. This could have been accomplished by the steam shovel without blasting, but the rock was so tough that blasting was economical. The Cincinnatian formation consisted of layers of limestone separated by laminations of shale, which when first exposed was hard, but softened and sloughed so rapidly by exposure that in a month it could be picked to pieces. It was excavated on a 1:1 slope.

BLASTING

The blasted rock was handled by two 70-ton C Bucyrus steam shovels working together one 10-hour shift, and by one of these shovels working continuously day and night. The shovels handled an average of about 4,000 yards each per 10-hour shift, loading it into standard gauge 12-yard Western dump cars hauled by locomotives and used for making the embankment and levees.

When the steam shovel was operated on the same level as the dump cars, the rock was excavated in 16-foot lifts and the holes were spaced 13 feet apart. When the cars stood on the lift above the steam shovel track, the rock was excavated in 8-foot lifts in which the holes were spaced about 7 feet apart At the bottom of the cut the last lift was 28 to 30 feet high and 2,500 feet long.

Enough explosive was used to shatter the rock and throw it into a long windrow, which was removed by the steam shovels traveling from end to end and loading it into dump cars alongside. The excavation was made by the Walsh Construction Company, Davenport, Ia., under the superintendence of W. A. Durkin and was accomplished without serious injury of any of the employees.

EMBANKMENTS

The grade between Dayton and the dam is wholly in embankment which required 106,000 yards more material than was available from the cuts. The construction of the levees also required so much embankment that the embankment and fills for the total job were unbalanced by an amount of 400,000 yards, most of which was secured by increasing the width of the cut and the remainder by opening borrow pits.

Between Dayton and the dam two railroad bridges were eliminated by the construction of a cut-off channel in the river which required the excavation of 34,000 yards of material by clamshell buckets and 10,000 yards by teams and scrapers.

On the upstream side of the dam there are twin levees 200 feet apart, 35 feet in maximum height and 1½ miles long, together requiring 469,000 yards of embankment, nearly three-fourths of which were taken from the Huffman cut. About 40,000 yards were furnished by excavating between the levees with an elevating grader and dump wagon for the sub-grade of the railway tracks. For 3 miles the embankment in wet, miry soil was obtained by side borrow with elevating grader, constructing a narrow embankment which was afterwards widened by side dump from cars hauling spoil from the steam shovels in the cut.

TRACK LAYING

The tracks were laid with 90-pound rails and creosoted 7 x 8-inch ties 8½ feet long and 18 inches apart on centers. Standard tie plates are used on all curves and the road is ballasted with gravel having a minimum thickness of 12 inches below the bottoms of the ties and requiring 3,490 cubic yards per mile of single track.

Because it was necessary to shift the original location of the tracks near the dam in order to commence construction on the outlet conduit at the earliest possible date, a preliminary re-location about 1⅓ miles long, was made which required 53,800 yards of rock excavation and provided for traffic during two years before the permanent re-location was completed.

The work was done by contract and was executed under the supervision of railroad engineers and of the division and the assistant engineers of the Conservancy Commission, of which Arthur

E. Morgan is chief engineer and Charles H. Paul assistant chief engineer. It was described in the "Miami Conservancy Bulletin" for October, from which the accompanying illustrations are reprinted.

Sand Filters for Small Sewage Plants

By W. A. Hardenbergh

When suitable; construction requirements of several state health boards.

In a recent issue the disposal of the effluent from residential and other small sewage treatment plants by means of sub-surface irrigation was discussed at some length, and the recommendations of various state boards of health were given.

Under certain conditions this method of treatment is best suited for residence and small community use. These conditions include a well-laid distribution area and a porous soil. The latter, unfortunately, cannot always be secured, and costly substitutes must be found. Also, in the case of institutions using fairly large quantities of water, a considerable area is required. Finally, the effluent is applied to the soil in the manner best suited to cause pollution of ground water.

Intermittent sand filtration yields very good final effluent; but considerable care is necessary for proper operation. Where this care can be secured, the small sand filter will prove most satisfactory. The only local necessity is sufficient fall to allow the filter to operate. With the ordinary septic tank, siphon and sand filter, about 5 feet of fall is usually needed. The presence of local sand supplies will reduce the cost.

The Illinois State Board of Health does not recommend the use of the sand filter in cases where less than 25 people contribute sewage. A depth of sand of three feet is recommended, with a carefully constructed underdrain system of drain tile and graded gravel. The area of the installation is figured on the basis of one acre for every 750 people. This would give about 1,450 square feet for the minimum installation of 25 persons. Three beds are recommended, allowing the use of two beds alternately, while the third is being cleaned, repaired or rested.

Particular attention is called to the necessity of supervision. The beds should be visited every few days. At intervals of a month or so it becomes necessary to rake or scrape the bed slightly, so as to break up the surface mat. Furrowing or covering may be necessary in cold climates in the winter.

The Public Health Service has published in Bulletin No. 101 the result of investigations of house and small community sewage disposal carried on by Frank and Rhynus. The recommendations given here are: Thirty square feet per capita of sand beds for flows of 20 gallons per person per day; forty-five square feet of sand beds per capita for flows of 100 gallons per person per day, with proportionate areas between these extremes. The filter depth is suggested as not less than 24 inches. As high as 36 inches may be of advantage where the head is available, as this additional height allows removal of surface layers while cleaning. The effective size of the sand should be from 0.3 to 0.5 mm. and the uniformity coefficient not more than 4. The underdrainage should be a four-inch layer of broken stone or gravel, one inch to two inches in size, supporting a 2-inch layer of broken stone or gravel one-fourth to three-fourths inch in size.

Covers are recommended for these small beds. This will prevent growth of vegetation in warm weather and the formation of ice in cold weather. Inspections should be made every month, but the beds should not require raking more than three or four times a year.

The Wisconsin State Board of Health illustrates in their publication a filter from 2 to 3 feet in depth, and recommends a surface area of 20 to 30 square feet per person, depending upon the flow, character of the filter, etc. This bed is underdrained with open-joint tiling. Distribution on the surface of the filter is by troughs laid with a fall of 1 inch in 50 feet, and provided with outlets at intervals of 10 or 12 inches. The troughs are 4 inches wide and 3 inches high and have ¾-inch outlets. Weekly alternation in the use of beds is considered essential.

The Ohio State Board of Health suggests the use of from 24 to 30 inches of sand of a grade similar to that required for mortar. It "should be of good uniformity, clean, and free from loam, and for best results should have an effective size of from 0.3 to 0.45 mm." The bottom of the beds should be sloped to the center, and about 6 or 8 inches of gravel placed around the underdrains. The lower layer of gravel should range in size from one-quarter to one inch, above which should be placed a 2-inch layer of pea-size gravel to prevent the washing of the finer filter sands into the underdrains. The uniformity coefficient of the sand should be from 1.5 to 2.5, according to this authority.

The area of the beds is determined upon the basis of 100,000 gallons per acre per day. This allowance figures out to be about 22 square feet of filter surface per person. For the larger installations, two alternating siphons should be used, but in single residences this is scarcely necessary. Distribution is through a 6-inch tile line which has an outlet on an apron at the center of each bed. In the case of the larger beds, where equal distribution cannot be secured from one point, troughs may be used.

In the case of sand filter installation, operating care and maintenance are the prime requisites. Without proper care and maintenance, the intermittent sand filter will not work, whether the installation be large or small. On that point alone are other methods of small plant disposal superior. From the standpoints of cost, quality of effluent and universal adaptability, the sand filter is far superior to other methods.

Work on the $100,000,000 Welland Ship canal is to be resumed by the contractors, it is reported. In 1917 it was taken from the contractors and stopped, but later resumed on a cost-plus basis.

Water Rates in Small Minnesota Villages

Method employed in fixing the meter rates in a village of 3,500 population.

A paper entitled "Water Rates in Small Cities and Villages" was read before the Minnesota section of the American Water Works Association by John Wilson, consulting engineer of Duluth, in which he described the method employed in fixing the rate of the village of Crosby, Minn., a village with a population of about 3,500. The water works plant was installed in 1911 by a private company and taken over by the village in 1918. On taking over the plant the village decided to determine by scientific methods what would be a proper and fair schedule of rates.

The first step was to determine what amount should be chargeable to the village at large, this including fire protection. It was estimated, by careful consideration of all features, that 51.6 per cent of the appraised value and 45.9 per cent of the cost of extensions to be made might justly be charged to fire protection. (The assessed value was $75,680 and $56,000 was spent in extending distributing mains and additional fire hydrants.) For reasons of policy as well as equity the village decided to pay for installing meters and laying connections from the main to the curb box, this cost to be considered in calculating the service charge. Service charges were fixed at 40 cents per month for ⅝-inch meters, 75 cents for ¾-inch and so on up to $12 for 4-inch. Estimating the number of meters of the several sizes, it was then possible to determine the fixed amount which the village would obtain from its commercial service.

An estimate was made of the number of cubic feet a year that would probably pass through the ⅝-inch meters and that which would pass through the larger ones, the amount which would pass the meters without registry and that which would be used for street sprinkling and other public uses, including fire extinguishing. It was clear that the amount measured by meters and that passing the meters without registry should be paid by the water consumers; that the amount used for extinguishing fires should be charged to fire protection, and that the remainder should be charged to the village at large. Such items as clerk's salary were all charged to domestic service, while the fire service was charged with its share of interest on bonds, maintenance of fire hydrants, etc., In lieu of any figures available for determining the amount of water that would be pumped and unaccounted for, this amount was assumed at 40 per cent.

The total annual expense of the department was then estimated, this including 6 per cent interest on the bonds and on other indebtedness, the amount of the clerk's salary chargeable to the water department, the superintendent's salary, labor, office supplies and postage, fuel, meter repairs, maintenance and depreciation, electric current, insurance and telephone. The total was $14,857.

A considerable part of the cost of extensions had been incurred because of requests of citizens whose private wells had been destroyed by mining operations. Moreover, it did not seem just to place all of this additional expense on such consumers as the village already had, it seeming proper that the plant should operate at more or less financial loss while establishing the business. It was therefore decided to deduct $1,700 a year from the return on these extensions chargeable to the commercial consumers and add it to the amount to be borne by the village at large.

There resulted from the above considerations a payment for fire protection of $5,925; water used by the village at 18 cents per hundred cubic feet, $1,000; and the $1,700 just mentioned; a total paid by the village of $8,625. This left $6,232 to be derived from the private consumers. The service charges would yield $2,161, leaving $4,071 to be raised by meter charges. It had been estimated that the amount of water used by the private consumers would total about 1,628,500 cubic feet, and this gave a meter rate of 25 cents per hundred cubic feet, which was the rate adopted. The calculation resulted in a payment by the village of 58 per cent of the total annual expense and by the water consumers of the remaining 42 per cent. It is interesting to note in this connection that the Wisconsin commission ruled that in the case of Ashland the city should pay 54.5 per cent of all fixed charges, and that in the case of Ripon the city should pay 75 per cent.

Mr. Wilson referred to some features of rates throughout the state and, among these, noted that hydrant rentals in the state ranged all the way from $4 per hydrant per year to $140, while 57 per cent of the water plants of the state received nothing whatever from the municipality in the way of hydrant rental or payment for fire protection. (There are 202 water works plants in the state, of which only 7 are privately owned.)

The rates in most cases are on a sliding scale, the most extreme case being a town with a little over 3,000 population where there are 21 different rates for water and 20 different rates of discount for payment of bills, giving a possible separate combination of water rate and discount rate for almost every consumer.

Duluth Water and Light Notes

In his report for the year 1920 of the water and light department of Duluth, D. A. Reed, manager of the department, states that during that year the consumption of gas was 20.2 per cent greater than that for 1919, while the increase in number of customers was only 8.2 per cent. The only explanation offered was the tendency of the people to be more liberal in their expenditures.

The gas supplied by the city is obtained from

the Zenith Furnace Company, whose plant is in West Duluth. It is transmitted the full length of the city through high-pressure mains, from which it is discharged into low pressure distributing mains at various points through regulating governors.

Duluth has an interesting method of assessing for extensions of its water and light distribution systems. In 1914 the city began making extensions on the basis of assessing 8 per cent of the cost annually against abutting property, while one-half of the amount which said property pays for water and one-third of the amount which it pays for gas are credited to the assessment. If there is no consumption of water or gas the property pays the department a straight 8 per cent annually for not exceeding fifteen years, which takes care of the interest on the investment, depreciation and a small amount for maintenance, but returns very little, if any, on the principle. Of seventeen extensions made in 1914, six no longer have to pay assessments, the revenues being sufficient to more than balance the 8 per cent. Of those made in 1919, however, the assessment amounts of $5,629 were practically all paid, the amounts actually assessed in 1920 being $5,280.

Repairing Water Works Steam Pump

An unusual welding repair on a large cast steel hydraulic cylinder of a steam pump operated by the city of East Liverpool, O., water works and filtration plant is reported by the Metal and Thermit Corporation, New York City.

The casting having developed a 20-inch crack, an attempt was made to repair it by oxy-acetylene welding, but another crack developed as a result of contraction strains and the cylinder was then welded by the thermit process.

The broken sections were lined up together, leaving a small gap between them to provide space for the thermit steel. Yellow pattern wax was inserted in the gap and a mold formed around the wax. A pre-heating torch was then directed into the mold, drying it, burning out the pattern wax, and pre-heating the sections to be welded.

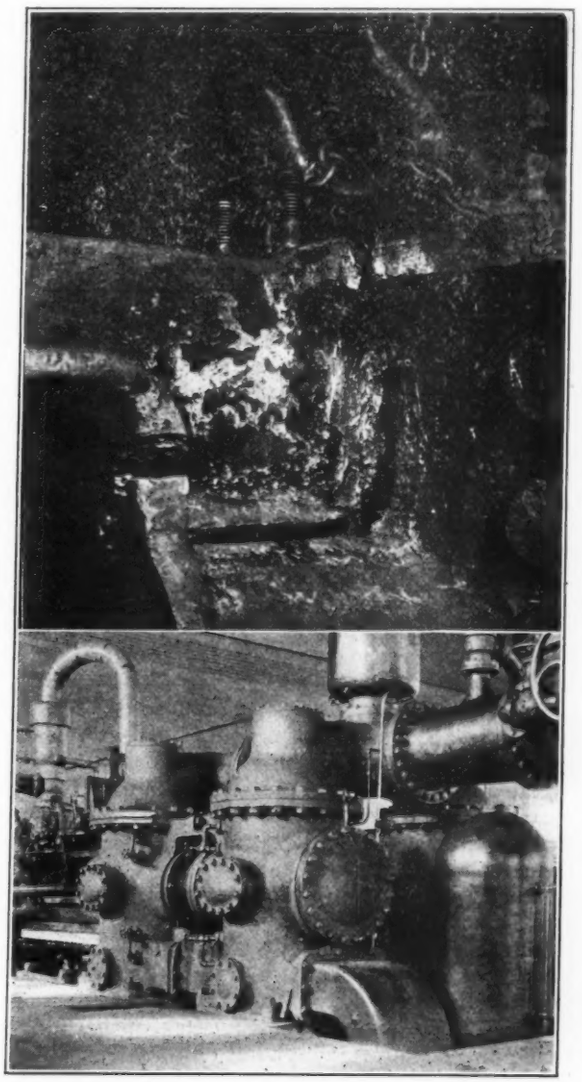
When the sections were heated sufficiently, a charge of thermit (which is a mixture of iron oxide and aluminum) was ignited in a crucible suspended over the mold. The chemical reaction was started at the extremely high temperature of about 5,000 degrees Fahrenheit, during which the aluminum combined with the oxygen of the iron oxide to form aluminum oxide or slag in a highly super-heated molten state, while the iron was set free and produced as liquid steel. This reaction required only about 35 seconds, at the end of which time the liquid steel was tapped from the crucible into the mold, and these amalgamated thoroughly with the broken surfaces of the two sections.

The metal of the weld was allowed to cool slowly, after which the moulding material was removed, the excess metal cut off, and the welded cylinder returned to service where it is giving perfect satisfaction while being operated constantly under a pressure of about 130 pounds per square inch pumping filtered water to a reservoir.

Belt Conveyors for Aggregate

The Barney Ahlers Company, New York, installed a duplex belt conveyor system for transporting, elevating and storing aggregate for concrete construction at Montville, Conn. As the aggregate was delivered by barges that on account of shallow water could not approach within 100 feet of the shore line, and as the site itself was too soft and marshy to permit track-laying or road-building on its surface, a pier was built at right angles to the shore line and at the extremity the barges were unloaded by a clam-shell bucket and derrick delivering to the hopper of a 125-foot conveyor belt ascending at an angle of 20 degrees and delivering to the top of a circular storage pile with a loading tunnel underneath.

In the loading tunnel there was installed a second inclined belt conveyor 279 feet long extend-



CUT AT FRACTURE PRELIMINARY TO WELDING
STEAM PUMP WITH WELDED CYLINDER IN OPERATION

ing at right angles to the first conveyor, obliquely intersecting the shore line, and filling a storage bin on the deck of a sunken barge located in the water opposite the construction work and entirely outside of the working area. The bin delivered by gravity to the mixer and the concrete was hoisted by a tower installed on the barge, and then spouted to the forms.

Effect of Cal in Portland Cement

Result of an investigation by the Bureau of standards indicates acceleration of setting without reduction of the ultimate strength.

With the introduction of more rapid methods of construction and the increasing amount of concrete repair and replacement work, the need for a material for accelerating the hardening of Portland cement has become more pressing, and considerable attention has been given it, notably by the United States Bureau of Standards, which found calcium chloride the most effective of the various substances tested.

Inasmuch, however, as the use of commercial calcium chloride in concrete is attended by difficulties due to its highly hygroscopic nature, Charles Catlett conceived the idea of introducing the salt by means of Cal, which material possesses possibilities even greater than those of calcium chloride, since upon decomposition by water, its products are calcium chloride and calcium hydroxide, equivalent to calcium chloride and finely hydrated lime. And since both these materials are now being used separately to advantage in cement mixtures, it was not considered that the use of Cal introduces any novel feature in the making of concrete except the manner in which these materials are added.

Accordingly, an investigation was inaugurated by Mr. Catlett, with the co-operation of the Bureau of Standards, to study the effects of Cal on Portland cement mixtures, the most important object of this being to learn the value of Cal as an accelerator of the hardening of concrete. The following is an abstract of a report recently issued by that bureau as a result of the investigation:

Cal is a dry, white powder obtained by pulverizing the dried or undried product resulting from a mixture of either quicklime or hydrated lime, calcium chloride, and water. It may be handled in much the same way as hydrated lime and has the same general keeping qualities and is much more convenient to handle and use in making concrete than calcium chloride, either fused or in concentrated solution. Cal, upon exposure to the air, gradually takes up carbon dioxide and becomes somewhat damp. Tests show, however, that long exposure does not affect its action as an accelerator of the hardening of Portland cement mixtures.

The setting of normal Portland cement mixture may be hastened to a great extent by the use of Cal. This hastening of the set is particularly desirable in concrete construction requiring a finished surface, and is not objectionable in any type of construction provided the concrete is placed soon after it is gaged with water. It is believed that Cal increases the workability of Portland cement mixtures. No attempt was made, however, to measure the extent of this effect, because up to this time no satisfactory test has been developed for measuring the workability of Portland cement mixtures.

It has been shown that unsound cements may be greatly benefited or made sound by an addition of Cal, which effect was produced in neat pats subjected to the steam test and in mortar test pieces stored in air.

Limited tests show that quick-setting cements, whether fresh or having become quick-setting on ageing, may be made normal by the addition of Cal as used in cement mixtures.

There was no indication that the amount of efflorescence appearing on the surface of cement mixtures exposed to the weather is increased by the use of Cal.

Tests have been made of the effect of Cal on steel reinforcing bars which were embedded in a thin layer of Cal cement mortar and exposed to the weather for 8 months without corrosion; but these tests, while favorable, are insufficient to give assurance that corrosion will not occur under these conditions. Care must therefore be taken in the use of Cal in concrete containing steel reinforcement when the concrete is to be freely exposed to the weather or excessive dampness, though in ordinary building construction no bad effect is believed to result.

Undried Cal mixed with Portland cement causes a greater deterioration of the quality of the cement during storage than ordinarily takes place. Cal, therefore, should be added to the concrete materials during the mixing operation, preferably before the water is added.

Calculations made from tests in which the test pieces were stored in water, damp sand or damp closet, showed that all Portland cement mixtures treated with Cal attained greater strength at the 2-day and 7-day periods than the corresponding untreated mixtures. The increase in the strength of mortar at the 2-day period obtained by the addition of 5 per cent Cal to cement ranged from 40 to 140 per cent. The strength of the treated mortar at 2 days was equal to that of the untreated at 3½ to 8 days.

Treated mortars stored in the laboratory air attained at 2 days strength greater than that of the untreated mortars at 28 days, due to the rapid drying out of the small test pieces and the comparatively slow rate of gain in strength after the 2-day period. This shows Cal to be especially advantageous in cement mixtures which are necessarily subjected to any drying-out action.

The increase in strength produced by 5 per cent Cal in concrete mixtures at the 2-day period ranged from 52 per cent to 135 per cent, and the

strength of the treated concrete at this 2-day period equaled that of the untreated at from 3 to 4½ days. This represents a saving, on an average, of half the time in operations dependent on the strength of the concrete at early periods. The effect of the air storage in the concrete tests was lessened in degree, owing to the high relative humidity which existed throughout the storage period.

This increase in strength resulting from an addition of 5 per cent Cal does not represent the maximum which can be obtained except in very rich mixes. As much as 15 per cent Cal was used in mortar tests, giving an increase of 220 per cent at the 2-day period.

The general effect of Cal on Portland cement is the same as might be expected from equivalent amounts of hydrated lime and calcium chloride, and the 3-year tests by the Bureau of Standards on concrete gaged with a solution of calcium chloride are sufficient grounds for the belief that Cal will not in any way affect the ultimate strength and integrity of Portland cement concrete.

Advantages of Bituminous Concrete Foundations

Summed up under ten heads by Hugh W. Skidmore, of Chicago Paving Laboratory.

A few weeks ago, Hugh W. Skidmore, of the Chicago Paving Laboratory, read a paper before the Illinois Society of Engineers in which he advocated bituminous foundations for pavements. He stated that European engineers "maintain an extremely sceptical attitude toward rigid pavements." He briefly traced the history of bituminous foundations from the bituminous base pavements in Washington, D. C., to the present extensive use in California. He stated that a cement concrete base generally retained a film of moisture at the contact plane between it and a bituminous wearing surface, which not only tends to disintegrate the bituminous material, but also acts as a lubricant which is one of the causes of the pushing or rolling of an asphalt surface on a concrete base.

He said that while "reasonably good drainage must be provided if real success is to be obtained from the use of bituminous mixtures for foundation purposes," the same is true of other types of foundations as well.

He cited several contractors as claiming that the use of a bituminous base instead of concrete would save from 35 cents to a dollar or more per square yard, Owensboro, Ky., having saved more than $1 on the basis of 1917 prices. He summed up the advantages of bituminous concrete under ten heads, as follows:

(1) Provides homogeneity of mass and positive bond between foundation and wearing surface when bituminous top courses are employed.

(2) Provides uniform contact with the subgrade, thus insuring the benefit structurally of all of the beam strength possessed by the foundation slab and by the same token, makes certain uniform distribution of load to the subgrade.

(3) Because of the inherent flexibility of the material, the foundation slab will at no time be called upon to act as an arch over weak subgrade areas, therefore the possibility of the foundation rupturing, as is frequently the case with Portland cement-concrete, will be reduced to a minimum.

(4) Provides freedom from cracks and upheavals.

(5) Insures against the presence of moisture in the foundation structure, thus prolonging the life of the pavement.

(6) May be easily repaired at minimum cost; the surface patch method being applicable except in the case of very serious defects.

(7) Provides decided economies in construction as it disposes with the equipment and organization necessary to lay cement-concrete, thus affording the contractor the advantage of exclusive use of that portion of his ordinary equipment and labor organization which in actual operation has heretofore proven to be the most economical, and thereby profitable.

(8) Does away with the long period of time required for curing of the foundation, thus permitting the opening of completed work to traffic immediately and providing a rapidity of turnover to the contractor not possible in the case of rigid foundations.

(9) Permits the use of the same materials, except cement, as are employed in cement-concrete work.

(10) Under similar conditions, using the same aggregate materials bituminous concrete of equal thickness will be found to be cheaper than cement-concrete at present prices.

New York City Transit

Rapid growth of traffic demands radical changes and great increase of passenger transportation facilities. $550,000,000 expenditures estimated for next 25 years.

The annual report just submitted by Transit Construction Commissioner John H. Delaney to the legislature of the state of New York deals with the passenger transportation lines in New York City, of which there have been opened in 1920 nine different lines and extensions that have cost, in the aggregate, $67,150,000. During the year 41 contracts have been accepted as completed, 4 defaulted contracts have been relet, and 24 new contracts have been awarded.

During the year ending June 30 the total number of passengers carried by the rapid transit and surface railroads was 2,364,775,067, showing an increase of 284,832,063 over the passengers in the

preceding year. The report says: With an annual increase in traffic exceeding 10 per cent it is obvious that provision must be made without delay for extension of local transit facilities for all sections of the city. When the dual contracts were signed in 1913 the rapid transit lines carried 810,000,000 passengers for the twelve months immediately preceding the adoption of the new program. There has been an increase of approximately 615,000,000 passengers, or 76 per cent, in the intervening seven years, and the new trunk lines are already showing congestion.

Intensive study has been given to the rapid transit needs of the future and a report made on a comprehensive plan intended to meet the requirements of the various boroughs of the city during the next twenty-five years. The plan was so laid out as to encourage municipal growth in every direction and to prevent abnormal and congested conditions in certain sections and strangulation of growth in other areas. As laid down it is intended that the transit plan and the general city plan for new thoroughfares and highway improvement shall be co-ordinated in order that the best results may accrue to the general public. The growth of traffic per annum has been constantly in excess of the annual per capita growth of the city.

The enlarged system as laid out to care for the city's needs during the next twenty-five years would provide for an annual traffic of 5,000,000,000 passengers. Projected lines and extensions to the existing lines wherever they may originate in outlying boroughs are planned to enter and traverse the heart of the city which, from the transit viewpoint, is the area in Manhattan south of Central Park between Second and Tenth avenues.

The new transit plan takes into consideration the fact that vehicular and pedestrian traffic in the city streets is increasing to such an extent that it will soon be regarded as inadvisable to continue surface car operation either on the main arteries of travel or on the main cross-streets of Manhattan Borough, and that surface passenger transportation must be by subway travel with crosstown "tie lines" operated on a moving platform device, shuttle cars or by omnibuses. Because of the fact that the congested section of Manhattan has but 11 north and south through traffic arteries to serve more than 150 cross streets, it will be necessary to resort to "double deck" subway trunk lines in the central traffic arteries of the city that remain available for transit lines.

No close estimate of the cost of construction of the enlarged transit system is possible at present and it is not intended that the comprehensive scheme as laid out in its entirety will be undertaken at once but that it should be proceeded with methodically and continually. At pre-war prices it is estimated that the lines contemplated in the suggested program for the next twenty-five years would cost approximately $175,000,000 for construction. At present prices, however, this cost would amount to close to $350,000,000, exclusive of equipment, interest during construction, engineering and superintendence. For proper facilities and equipment an additional $200,000,000 would probably be required at present price level.

Pavements Laid During 1920—A Correction

In the tabulated data given under this heading in last week's issue there were a number of errors made by the printer in spite of repeated attempts at correction made by the editor. We greatly regret these, and give below the corrections of the several errors, which seems to be the best we can do to remedy the mistakes. We hope that subscribers will make these corrections in their copies in order that future reference to the tables may not yield incorrect information.

In the table at the top of page 266, under "Asphalt Concrete," the 7,373 is lineal feet and not square yards; and the 0.44 applies to Toronto and not to Walkerville. The quantities under "Bitoslag" should all be under "Warrenite-Bitulithic," and the 12,377 applies to Brampton and not to Port Angeles. The 30,050 is Bitoslag.

On pages 267 and 268 the names at the tops of the columns should be those appearing in the first part of this table, on the lower half of page 266, that is, should be "Amiesite" instead of "Sheet Asphalt," "Granite or other stone block" instead of "Asphalt Concrete," etc.

On page 267, fifth column, 19,263 applies to Irvington and not to Bridgeton, and 2,400 to Millville and not to Irvington. Sixth column, Sioux Falls, 2.70 should be 2,700. Seventh column, 71,021 applies to Paterson and not to Roosevelt. Eighth column, ½ applies to Millville and not to Paterson. Ninth column, Columbus, Kan., insert ¼; Irvington, N. J., insert 32,437§; the 20,000 applies to Roosevelt and not to Roselle Park; Media, Pa., insert 3,000b; the ¾ applies to Bonham and not to Childress; the 4 applies to Eastland and not to Cisco.

On page 268, second column, Toronto, Ont., insert 0.4. Third column, Moundsville, W. Va., insert 2,100. Fifth column, 5,880 applies to Bennington and not to Galveston; the 16,000 applies to West Allis and not to Port Angeles, and the 1.76 to Toronto and not to West Allis. Sixth column, 3,467 applies to Auburn and not to Roanoke; the 3 for Moundsville should be omitted; the 1¼ should be 1½. Seventh column, 1.1 applies to Roanoke but to neither Rutland (misspelled Ruthland) nor Auburn. Last column, the 1,442 applies to Auburn and not to Roanoke; 1¼to Ashland and not the Clarksburg; 400 to Lake Geneva and not to Menasha (misspelled Menosha).

Good roads advocates of Alabama are proposing resubmitting to popular vote the proposition to bond the state for $25,000,000, the previous election having been declared illegal, as told in our March 19 issue. A poll of the legislature indicates that the vote would again have a large majority in its favor.

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Construction Budgets

Movement for the control of Federal expenditure in accordance with a general budget is nowhere more important than in relation to construction work, where the principle applies equally to state, county and municipal undertaking. The absence of the budget tends to make the work uncertain, defective and too costly, affording vast opportunity for extravagance, dishonesty, political manipulation and embarrassment to efficient and conscientious people associated with its planning and execution.

No successful private or corporation business is carried on without a very careful preliminary survey, analysis, estimate of cost and appropriation of a reliable budget, which is conspicuously absent in the United States Government and in that of many subordinate departments of this country. While it is important in every department, it is in none of them more vital than in construction of public work where forethought, uniformity, safe practice and ample resources ably conserved are indispensible to success and efficiency.

A budget and a reorganization and co-ordination of the different construction branches throughout the country could diminish waste and provide for adequate preliminary surveys and analyses, thus insuring suitable design. It would secure adequate resources for approved operations, thus saving enormous waste and expense due to delay, interruption and ill-advised operation. It would promote great savings by the adoption of standards, concentration of direction and skill, and the elimination of duplication of labor and supplies. It would promote the greatest efficiency, economy and expedition of work and the development of permanent technical and construction forces of the highest grade.

The establishment of the budget system was strongly urged by Judge Warwick, Comptroller of the Treasury of the United States in a recent paper before the Associated General Contractors of America. His view should be indorsed and efficiently supported by all contractors, engineers and officials who are interested in public construction and its welfare.

Disposal of Municipal Refuse

No city is providing for the convenience and health of its citizens to the extent which they have a right to expect if it is not collecting and disposing of all rubbish and ashes as well as garbage. In performing this service, the health and convenience of all the citizens should be the first consideration, but of course a limit will be placed by the cost of improved service.

In connection with cost, many alluring statements have been made concerning profits to be derived from reduction of garbage or feeding it to pigs; from creating steam by burning rubbish or from the sale of materials salvaged from it. Any of these claims should be examined carefully by an expert before acceptance for any given case.

In the first place, we believe no city has ever recovered, by any municipal treatment of waste, a net profit covering cost of collection as well as of disposal; and very few can show a net profit from disposal alone; in fact, we know of none that can do so if sufficient allowance be made for interest and depreciation of plant. It must, of course, be recognized that in any event some disposal must be made of the refuse, and if the net cost is less for any given method than for others equally acceptable otherwise then that one is preferable.

But plants for incinerating rubbish have been provided with steam-raising adjuncts at such great additional expense, and so little use actually made of the steam, that the value of such use seldom covers the interest alone on the adjunct, to say nothing of repairs and depreciation. Also,

rubbish is sometimes hauled long distances to a special plant and subjected to salvaging operations at considerable cost, when the returns from sale of the salvaged material will not cover the cost of such operations and of the additional haul which could be avoided by use of local incinerators or possibly of several dumps.

Again, utilization of garbage by pigs or reduction plants leaves rubbish and ashes unprovided for, and as stated above, the city should collect and dispose of these also. The collection, transportation and disposal of all three kinds of refuse is one composite and complex problem, and solving one of the elements of it without consideration of the others is the height of unwisdom. Both forms of utilization require expert knowledge and constant, conscientious vigilance —and cities seem to find it difficult to obtain and retain either of these. Even private pig raising companies fail to make profits—three have recently thrown up their contracts with cities.

With very few exceptions the wisest plan for any city is to waste no time figuring on how to make a profit from its refuse, but to concentrate on collecting and disposing of it with a minimum of objectionable features and of cost. While at present some large cities may find other plans preferable, and for the small ones the smallest incinerator unit may be too large, and the smallest disposal unit—the pig—may be advisable, or burial outside the occupied area; yet the most promising method of disposing of rubbish and garbage, for all but the smallest and largest cities, seems to be a good incinerator, with no expensive boiler attachment for raising steam, but of a design and construction that will burn all the refuse without odor or purchased full and at little cost for operation, upkeep and repairs.

Paving in American Cities

A tabulated statement of paving conditions in 195 American cities (including 84 of the 227 having more than 30,000 population), showing conditions at the beginning of the year 1920 has just been published by the Asphalt Association. The figures show for each city the total amount of pavement and the number of square yards of gravel, water-bound macadam (each of these including those with surface treatment), bituminous macadam, asphaltic concrete, sheet asphalt, brick, Portland cement concrete, asphalt block, wood block, stone block, other asphaltic pavements, and other non-asphaltic pavements.

In amount of pavement, New York leads with 41,375,576 square yards, Chicago is next with 38,430,330, Philadelphia is third with 22,609,962, Los Angeles is fourth with 21,515,424, Boston is fifth with 11,158,919, Pittsburgh is sixth with 10,403,200, and the only other city in the list with more than 10,000,000 yards is Cincinnati with 10,169,709, this including alleys.

The total amount in all the cities listed is 364,901,611. Of this, 28.97 per cent is sheet asphalt. 16 per cent is water-bound macadam, 13.96 per cent is brick, 10.23 per cent is gravel, 10.18 per cent is stone block, 7.25 per cent is asphaltic concrete, 3.91 per cent is bituminous macadam, 2.95 per cent is Portland cement concrete, 2.83 per cent is wood block, 1.75 per cent is asphaltic block, 1.37 per cent is other non-asphaltic types and 0.63 per cent is other asphaltic types.

The statement also gives the oldest pavement of each type in each of 25 leading cities. These oldest pavements are classified by types and arranges by decades. Only one pavement in service in any of the cities was laid prior to 1880, this being a sheet asphalt laid in Washington, D. C., in 1873. In the decade 1880 to 1889, 6 cities laid sheet asphalt pavements that are still in service, 7 cities laid granite block, 2 laid brick and 1 wood block. In the decade 1890 to 1899, 13 cities laid brick, 9 laid sheet asphalt, 3 laid granite block, 3 macadam and 1 wood block. In the decade 1900 to 1909, 6 laid asphalt concrete, 5 laid macadam and granite, 5 sheet asphalt, 5 Portland cement concrete and 5 wood block, 4 laid bituminous macadam, 3 granite block and 2 brick. In the decade 1910 to 1919, 13 laid asphaltic concrete that is still in service, 11 Portland cement concrete, 8 laid wood block, 5 bituminous macadam, 2 sheet asphalt, 1 brick and 1 granite block.

In each case the condition of each oldest pavement was indicated as excellent, good, fair, bad and poor. The only excellent pavements were the asphaltic concrete of Wilmington (1911) and Lincoln, Neb. (1912), the sheet asphalt of Wilmington (1905) and the wood block of St. Paul (1912). Combining these reported as good or excellent, we find asphaltic concrete leading with 94 per cent, sheet asphalt next with 82 per cent, then Portland cement concrete, 75 per cent; granite block, 64 per cent; wood block, 57 per cent; bituminous macadam, 33 per cent; brick, 27 per cent; and macadam and gravel, 14 per cent. As this includes pavements of all ages from 47 years to 1 year old, it is distinctly to the advantage of the newer types of pavement such as Portland cement concrete and asphalt concrete. There is, therefore, given the average age of all of the pavements listed under each classification. These averages are 12¾ years for granite block, 11½ years for brick and for sheet asphalt, 9 years for macadam and gravel, 4½ years for bituminous macadam and 4 years for asphaltic concrete and Portland cement concrete. We have endeavored to give a composite rating combining these two features (without claiming that it is a technically exact or correct method) by taking for each class of pavement the product of the average age and the percentage reporting good or excellent. These products so arrived at compare as follows: Sheet asphalt, 943; granite block, 821; asphaltic concrete, 376; wood blocks, 328; brick, 310; Portland cement concrete, 300; bituminous macadam, 148; macadam and gravel, 126.

The above comparison included only the oldest pavement of each type for each city and of course gives no indication of the condition of any other pavements in the several cities.

City Pavements to Be Laid in 1921

Information furnished by six hundred city officials during the past two months giving amounts of the different kinds of pavement that they were expecting to lay, together with the name and title of the official. Quantities are in miles or square yards (the size of the number indicates which) unless otherwise stated.

LIST OF ABBREVIATIONS

TITLES OF OFFICIALS IN CHARGE

B. E.—Borough Engineer
B. Sp.—Borough Superintendent
C. Ck.—City Clerk
C. E.—City Engineer
C. M.—City Manager
C. P. W.—Commissioner of Public Works
Ch. E.—Chief Engineer
Civ. E.—Civil Engineer
Co. E.—County Engineer
Co. Surv.—County Surveyor
Con. E.—Consulting Engineer
D. E.—District Engineer
Dir. P. W.—Director of Public Works
Dv. E.—Division Engineer
H. E.—Highway Engineer
M. P. U.—Manager of Public Utilities
S. P.—Superintendent of Paving Division
S. S.—Street Superintendent
S. St. Dp.—Superintendent of Street Department
S. & E.—Superintendent and Engineer
Sp. H.—Superintendent of Highways
Sp. P. W.—Superintendent of Public Works
St. C.—Street Commissioner
T. E.—Town Engineer
V. E.—Village Engineer

KINDS OF PAVEMENT

A—Amiesite
Ac—Asphalt Concrete
Am—Asphalt Macadam
B—Brick or Clay Block
Bg—Bitoslag
C—Concrete, not Reinforced
Cr—Concrete, Reinforced
Cs—Cement Sidewalks
G—Gravel
M—Plain Macadam
R—Rock Asphalt
S—Granite or other Stone Block
Sa—Sheet Asphalt
Tc—Tar Concrete
Tm—Tar Macadam
W—Willite
Wb—Warrenite-Bitulithic
Wd—Creosoted Wood Block

ALABAMA:
Bessemer, Gano W. Robertson, C. E., 59,000 Wb.
Florence, L. E. Goddard, C. E., 15,000 Wb.
Gadsden, Ernest Smith, C. E., 40,000 Ac, 11,000 B, 4,000 Cs.
Montgomery, H. A. Washington, C. E., 40,500 C, 7,000 Wb, 7,050 G.

ARIZONA:
Prescott, J. William Waara, C. E., 43,900 Wb, 8,250 C.
Winslow, J. W. McCreary, C. E., 12,000 Wb.

ARKANSAS:
Fort Smith, W. H. Evans, C. E., 40 Am or C.
Little Rock, Jas. H. Rice, C. E., 2 Ac, 1 C, 3 Cs.
Paragould, W. R. Heagles, W. R. Heagles & Sons, 20,500 Ac, 2 G.
Pine Bluff, J. H. Guest, C. E., 7,500 B, 27,500 C, 15,000 G, 2 Cs.

CALIFORNIA:
Bakersfield, R. H. Hubbard, C. E., 13,711 W, 9,200 C, 29,262 Cs.
Calexico, 16 Cs.
Chico, Frank S. Robinson, C. E., 60,000 Ac, 100,000 Wb.
El Centro, Philip W. Knights, C. E., 100,000 W, 5,000 lin. ft. Cs.
Los Angeles, John A. Griffin, C. E., 272,110 Sa, 11,020 Ac, 103,422 Wb, 203,550 C, 1,771.442 G, 2,016,904 sq. ft. Cs.
Monrovia, H. S. Gierlick, C. E., 4 C.
Napa, H. A. Harrold, C. E., 5,000 Am, 6,000 C, 2,000 Cs.
Ontario, F. E. Alford, C. M., ¼ C, 10 M, 2 G, 5 Cs.
Oroville, S. H. Norris, C. E., 31,400 Wb.
Palo Alto, J. F. Byxbee, Jr., 60,000 Ac, 65,000 C, 2,000 Cs.
Pasadena, E. P. Dervey, C. E., 72,000 Sa, 93,000 Am, 48,000 C.
San Francisco, James M. Owens, H. E., 50,000 Sa, 200,000 Ac, 1,000 S, 13,000 B, 25,000 C.
San Luis Obispo, Warren B. Burch, C. E., 25,000 C, 40,000 G, 5,000 Cs.
Vallejo, W. S. Kilkenny, C. E., 3,400 Ac, 2,000 C, 50,000 sq. ft. Cs.
Venice, W. F. Crawford, C. E., 1 Ac, 4 W, ¾ C.
Ventura, H. B. Ward, C. E., 48,000 Wb.

COLORADO:
Boulder, Jay Randolph, C. E., 10 G, 53,000 Sa or Ac or Tc.
Denver, C. H. Craney, S. P. D., 25,000 Sa, 150,000 Ac, 25,000 W, 50,000 C.
Fort Collins, W. B. Cheek, C. E., 78,845 Cr, 2,089 C, 6,000 G, 18,400 Cs.
La Junta, F. T. Lewis, C. E., 300,000 C.
Longmont, Edwin S. Bice, C. E., 32,000 C.

CONNECTICUT:
Bristol, 4,000 cu. yds. C, 20,000 sq. ft. Cs.
Derby, V. B. Clarke, C. E., $30,000 G.
Hartford, Leon F. Peck, S. St. Dp., 61,250 Sa, 19,920 Ac, 17,000 C, 35,000 M 5 Cs.
Manchester, J. Frank Brown, S. and E., 3 Cs.
Milford, V. B. Clarke, T. E., $10,000 Sa, $100,000 Am, 30,000 A.
New Canaan, Walter K. Goodhue, C. E., 5,000 lin. ft.
Norwich, Chandler Palmer, C. E., 10,000 C.
Stafford Springs, J. M. Leach, St. C., 7,000 Tc.
Stamford, Paul Nash, C. E., 10,000 Tm, 10,000 sq. ft. Cs.
Torrington, B. O., ½ Tm.
Wallingford, Wm. A. Mackenzie, B. E., 2,000 Ac.

DELAWARE:
Lewes, Chas. H. Lynch, E., 8,000 sq. ft. Cs.

DISTRICT OF COLUMBIA:
Washington, 64,000 Sa, 16,469 C, 1,000 M, 40,000 Cs.

FLORIDA:
Orlando, G. R. Ramsen, C. E., 100,000 B.
Sanford, Fred T. Williams, E. C., 16,000 Am, 30,000 sq. ft. Cs.

GEORGIA:
Albany, C. Q. Wright, C. E., 8.000 Ac.
East Point, C. E. Hutchinson, 5 Cs.

IDAHO:
Boise, C. C. Stevenson, C. E., 3 Cs.
Coeur D'Alene, W. T. Bassett, D. E., 13 C, 51 M.
Nampa, Louis C. Kelsey, Con. E., 55,000 Wb, 75,000 sq. ft. Cs.

ILLINOIS:
Benton, C. B. Mantz, C. E., 21,723 C, 18,335 novaculite.
Cairo, George F. Dewey, C. E., 2,400 B, 26,000 M.
Canton, E. F. Motsinger, C. E., 5,900 B.
Centralia, L. W. Lemon, C. E., 30,000 C, 20 Cs.
Champaign, F. C. Lohmann, C. E., 8,000 C, 10 Cs.
Chicago Heights, M. H. McCoy, C. E., 3,600 C.
Cicero, John Blazek, T. E., 5 Sa.
Danville, Harlan H. Edwards, C. E., 3,400 lin. ft. B, 2½ Cs.
Decatur, Preston T. Hicks, Sp. H., 2,950 lin. ft., 4 Cs.
Galesburg, F. M. Connolly, C. E., 21,015 B.
Geneva, Wells Engr. Co., 4,000 B, 21,000 C.

Joliet, A. S. Calkins, C. E., 30,000 Ac, 5,000 B, 40,000 sq. ft.
Kankakee, Robt. D. Gregg, C. E., 10,000 B.
La Grange, Edwin Hancock, E., 10,000 Sa.
Marion, P. B. Wilson, C. E., 12,000 C, 10,000 G, 350,000 sq. ft. Cs.
Moline, A. D. Payton, C. E., 70,000 Ac, 40,000 B, 7,700 Cr, 4,340 C, 100,000 sq. ft. Cs.
Mt. Carroll, S. C. Campbell, C. E., 6,000 B.
Murphysboro, R. A. Rollo, C. E., 60,000 B, 30,000 sq. ft. Cs.
Oak Park, Dudley C. Meyers, E., 35,000 Sa, 2,000 Ac, 6,000 C, 40,500 sq. ft. Cs.
Ottawa, George L. Farnsworth, C. E., 80,000 Ac, 3,000 B.
Pekin, Ben F. Smith, C. E., 13,200 B,
Spring Valley, P. M. Mahoney, C. Clk., 1 G, 2 Cs.
Waukegan, M. J. Douthitt, C. E., 3,035 C, 1,700 ft. Cs.
Wheaton, L. J. Ruddock, C. E., 6,600 C.
Winnetka, Frank S. Windes, Windes & Marsh, Engrs., 6,000 to 10,000 lin. ft. Cs.
Zion, Jas. J. Craig, ½ Cr, 1 C.

INDIANA:
Covington, Colonel W. Santman, C. E., ¾ Cr.
Elkhart, Harmon J. Weaver, C. E., 13,800 Sa, 10,050 B, 3,000 C.
Elwood, John D. Seright, C. E., 1,160 Cs.
Evansville, Jas. D. Saunders, C. E., 100,000 Sa.
Franklin, Thos. D. House, C. E., 10,000 Ac.
Fort Wayne, Frank M. Randall, C. E., 80,000 Sa, 60,000 Ac, 50,000 Cs.
Gary, W. P. Cottingham, C. E., 108,000 Sa, 27,000 Ac, 25,000 Am, 30,000 Tm, 35,000, Cr, 8,000 C, 6,000 Cs.
Greenfield, Charles Boone, C. E., 6 G.
Hartford City, Wm. Harley, C. E., 15,000 B, 7,000 Cr.
Jennings, Charles W. Miles, Co. Surv., 28,580 M, 5,317 G.
Kokomo, C. M. Ray, C. E., 6,338 Sa, 13,673 Cr, 2,656 cu. yds. G, 35,505 sq. ft. Cs.
Lafayette, H. F. Kessener, C. E., 20,000 B, 8,400 G, 5,600 Cs.
La Porte, Burtis P. Thomas, C. E., 30,000 Sa.
New Albany, Saml. T. J. Kann, C. E., 20,000 Cr, 10,000 C, 1,500 M, 25,000 Cs.
Peru, John Horan, C. E., 15,106 Sa, 15,500 B, 8,000 G.
South Bend, F. J. Anderson, C. E., 9,240 Sa, 29,800 Ac, 4,828 M.
Terre Haute, R. A. Koerner, C. E., 4,500 Wb, 20,300 C, 3 G, 3 Cs.
Wabash, H. D. Hartman, C. E., 18,000 Sa, 9,000 M, ¾ Cs.

IOWA:
Atlantic, T. E. Bichols, C. Clk., 6,000 C.
Boone, C. L. Elkhart, C. E., 10 Cs.
Charles City, James S. Dawson, E., 20,000 Ac, 15,000 Cr, 15,000 sq. ft. Cs.
Cherokee, Wm. Shardlow, C. Clk., 5,629 C.
Davenport, Roscoe K. Earle, C. E., 50,000 Sa, 50,000 Ac, 15,000 tarvia, 10,000 C.
Denison, Frank Woolston, C. E., 80 blocks.
Emmetsburg, T. R. Nartin, 7,500 Cs.
Fort Dodge, C. H. Reynolds, C. E., 45,000 Ac, 1,500 C.
Garner, J. G. Thorne, Con. E., Clinton, 50,000 Cr.
Kingsley, T. H. Johnson, Con. E., Sioux City, 65,000 Cr.
Mason City, Fred P. Wilson, C. E., 40,000 Cr.
New Hampton, W. R. Garland, C. E., 2 As.
Oskaloosa, H. C. Hawkins, C. E., 21,000 Ac.

KANSAS:
Arkansas City, C. W. Lusk, C. E., 62,000 B.
Columbus, C. M. Cooper, C. E., ½ G, ½ Cs.
Dodge City, Fred. Kirkpatrick, C. E., 25,000 B.
McPherson, H. A. Rowland, C. E., 3½ Sa.
Manhattan, Arthur J. Rhodes, C. E., 35,000 Ac, 15,000 B.
Ottawa, B. W. Harris, Comr., 2 blocks B.
Salina, P. G. Wakenhut, C. E., 20,000 Ac or B.
Topeka, W. E. Baldry C. E., 10,000 Ac, 1,800 B, 18,000 C, 6,000 sq. ft. Cs.
Winfield, T. P. Alford, C. E., 1 Sa, 2 B, 1,500 ft. M, 1 Cs.

KENTUCKY:
Ashland, Thos. Boggess, C. E., 19,700 Tm, 28,955 B.
Madisonville, George M. Flanagan, C. E., 17,000 R, 7.8 Cs.
Maysville, W. L. Glazier, C. E., 2,500 B, 5,000 Cs.
Middlesboro, J. C. Richardson, C. E., 44,250 R.
Newport, Jos. Hermann, C. E., 10,000 Cr, 3,000 M.

LOUISIANA:
Crowley, Merrill Bernard, C. E., 12,000, sq. ft. Cr, 2 G.
Kentwood, T. G. Wirnock, 2 G, 6 Cs.
Lafayette, L. J. Virgues. 20,000 B or Cr, 15 G.
South Highlands, A. A. Lyons, C. E., 45,000 Ac, 100,000 sq. ft. Cs.

MAINE:
Lewiston, John A. Jones, C. E., 21,000 Tm.
Portland, H. C. Robinson, Dv. E., 5,000 Ac, 5,556 S, 4,600 B, 1,911 C, 2,500 Cs.
S. Paris, Charles W. Bowker, Co. Comr., ½ C.
Westbrook, Alex. Jones, C. E., 4,000 Am, 525 B.

MARYLAND:
Frederick, Emory C. Crum, C. E., 500 Ac, 16,000 Am, 3,500 B.
Hagerstown, J. B. Ferguson, C. E., 15,000 Tm, 3,000 S, 2,000 Cs.

MASSACHUSETTS:
Andover, F. C. Cole, Sp. H., 1½ tarvia.
Attleboro, H. J. Goodale, Sp. Pub. Wks., 2 Ac, 600 Cs.
Braintree, Hartley L. White, ½ Ac.
Easthampton, M. J. O'Neill, T. E., 33,000 Am, ½ G, 1,800 Cs.
Greenfield, E. M. Schneck, S. S. and T. E., 5,000 Am, 2,600 Cr, 3,000 M, 15,000 G, 7,500 ft. Cs.
Holyoke, T. J. MacCarthy, C. E., 2 C.
Lawrence, R. W. Priestman, C. E., 60,000 Am, 13,800 S.
Millbury, W. B. Haine, 1½ C.
Newton, George E. Stuary, St. C., 13,400 Am, 10,500 Tm, 26,000 G, 26,000 sq. ft. Cs.
North Adams, W. I. Baucus, C. E., 5,000 C.
Orange, G. M. Underwood, S. S., 1 G.
Pittsfield, A. B. Farnham, E., 7,800 B, 20,000 C, 5,000 Cs.
Wakefield, W. R. Tompson, S. S., 7,500 Am, 11,000 G, 1,400 Cs.
Waltham, G. C. Brehm, C. E., 75,000 Am, 10,000 M.
Watertown, Forrest J. Maynard, T. E., 2,500 Sa, 13,500 Am, 10,883 C, 50,000 Cs.

MICHIGAN:
Alma, W. E. Reynolds, C. M., 2 Cr, 20,000 lin. ft. Cs.
Ann Arbor, Geo. H. Sandenburgh, C. E., 50,000 G.
Battle Creek, E. U. Haut, C. E., 50,000 Sa.
Bay City, H. C. Thompson, C. E., 2,000 Ac, 8,000 lin. ft. Cs.
Dowagiac, Clint Voorhees, Sp. P. W., 1,000 C, 2 G, 25,000 sq. ft. Cs.
Escanaba, W. J. Hudson, C. E., 20,320 Tm, 13,360 C.
Flint, 200,000 Sa, 400,000 Cs.
Hastings, Bert Sparks, C. E., 1 C, 1 Cs.
Holland, Jacob Zuidema, C. E., 20,000 Cs, 10,000-20,000 W or C.
Ironwood, Jas. Goudie, C. E., 10,000 Tm, 20,000 Cs.
Ishpeming, J. E. Hayden, C. E., 6,000 Am.
Munising, Albert Oas, C. Clk., 1,000 Tm.
Jackson, W. B. Hodges, C. E., 175,000 Sa.
Lansing, S. E. Eckert, C. E., 100,000 Sa, 4,000 B, 4,000 C, 3 Cs.
Muskegon, Ross J. Buck, Dir. P. W., 20,000 Sa.
Saginaw, H. H. Eymer, C. E., 30,000 Sa.
Sturgis, Geo. A. Eagleton, C. E., 12,210 B, 33,000 C.
Three Rivers, O. O. Johnson, C. M., 4,000 ft. C, 1 G.
Ypsilanti, T. Fred Older, M. P. U., 5,000 C.

MINNESOTA:
Cloquet, Archie Campbell, St. C., 20,000 sq. ft. Cs.
Fairmont, Thos. H. Curtis, C. E., 8,000 Wb, 8,000 Cr.
Faribault, F. W. McKelly, C. E., 4,300 Cr, 3-5 M.
Hibbing, E. J. Hawley, C. E., 22,100 Wb.
Luverne, T. H. Johnson, Con. W., Sioux City, Ia., 145,000 Cr.
Minneapolis, F. W. Cappelen, C. E., 150,000 Ac, 18,000 S, 40,000 B, 71,000 Wd, 12,000 C, 40 Cs.
St. Cloud, M. B. Lang, C. E., 30,000 Wb, 15,000 Cs.
St. Paul, Ch. E., 150,000 Sa, 75,000 Ac, 20,000 Wd, 8,000 C, 75,000 Cs.
St. Peter, H. W. Daniels, C. E., 5.8 tarvia and oil.
Two Harbors, P. A. Cullen, C. Clk., 2,280 ft. Cr.
Virginia, E. F. Johnson, C. E., 26,000 Cr, 36,000 sq. ft. Cs.
Winona, E. E. Chadwick, C. E., 7,400 Tc, 50,000 sq. ft. Cs.

MISSISSIPPI:
Clarksdale, W. S. Bobo, C. E., 10,000 Ac, 38,000 G, 1,500 Cs.
Greenwood, F. T. Walker, C. E., 20,000 Ac.
Tupelo, N. B. Buchanan, C. E., 15 Cr. and C.

MISSOURI:
Batesville, W. R. Heagles, W. R. Heagles & Sons, 106,000 Ac.
Bethany, John J. Werninger, 3,000 C.

Booneville, T. T. Hale, C. E., 1¼ Am, 2,000 ft. B, 1,200 ft. C.
Brookfield, Lee Fletcher, C. E., 5,000 Tm.
Carthage, Frank B. Newton, C. E., 3 C.
Fredericktown, C. T. McCormick, Co. E., 5 G.
Fulton, F. E. Baker, C. E., 14,000 M, 2,000 G, 8,000 sq. ft. Cs.
Jefferson City, Linn F. Brown, C. E., 120,000 Am, 10,000 Cs.
Malden, W. R. Heagles, W. R. Heagles & Sons, 45,000 tarvia or Ac.
Poplar Bluff, E. C. Thomas, E., 20,000 C, 10,000 Cs.
St. Charles, Carr Edwards, C. E., 33,000 Tm, 20,000 B, 1,000 G, 3,000 Cs.
St. Louis, W. U. Horner, Ch. E., Sewers and Paving, 180,000 Sa, 136,757 Wb, 18,260 Am, 18,260 Tm, 7,985 S, 71,334 B, 8,470 Wd, 43,445 C, 30,000 sq. ft. Cs.
Sedalia, F. T. Leaming, C. E., 10 Am. 10,000 B, 10,000 C, 3 Cs.
University City, Walter A. Heimbuecher, C. E., 8,500 Cr, 27,353 C.

MONTANA:
Billings, E. M. Sneckenberger, C. E., 19,900 C.
Bozeman, C. C. Widener, Con. E., 23,000 Wb.
Great Falls, L. B. Evensen, C. E., 28,300 Wb, 19,000 Cr, 6,000 C, 35,000 sq. ft. Cs.
Havre, H. R. J. Meyer, C. E., 3 G, ½ Cs.
Lewiston, R. P. Longshore, C. E., 27,066 Cr.

NEBRASKA:
Fremont, L. M. Roessler, C. E., 1,500 B, 21,000 C.
Hastings, George B. Blautstone, C. E., 50,000 Sa, 10,000 B.
Homer, T. H. Johnson, Con. E., Sioux City, Ia., 15,000 C.
Lincoln, Geo. W. Bates, C. E. 20,000 Sa, 40,000 Ac, 20,000 B, 2,500 C, 200,000 Cs.
Nebraska City, C. A. Shannon, C. E., 40,000 B or Sa.
North Platte, C. J. McNamara, Civ. E., 70,000 covering Sa. Ac. Wb, B and Cr.
Omaha, H. E. Cotton, Asst. C. E., 50,000 Sa, 100,000 Ac, 50,000 B, 5,000 Cr, 20,000 C, 25,000 sq. ft. Cs.

NEVADA:
Reno, Harry Chism, C. E., 71,000 Ac, 2,700 C, 1 Cs.

NEW HAMPSHIRE:
Laconia, C. A. French, C. E., 10,000 Tm.

NEW JERSEY:
Bloomfield, Ernest Buechlin, T. E., 10,000 Sa, 10,000 Wb, 5,000 C, 1,000 M, 20,000 Topeka.
Bordentown, J. Horace Eaton, C. E., 882 Sa.
Bound Brook, H. M. Herbert, B. E., 9,000 Cr, 5,000 M.
Clifton, Russell S. Wise, C. E., 50,000 sq. ft. Cs.
Garfield, Anton L. Petterson, C. E., 83,508 Am, 70,766 sq. ft. Cs.
Highland Park, John T. Hopkins, B. E., 1 Cs.
Long Branch, J. W. Seaman, C. E., 25,000 Sa.
Millville, Newton B. Wade, C. E., 14,500 Cr, ½ G.
Newark, William A. Howell, E. in charge of Bureau of Paving, 40,000 Sa, 5,000 Wb, 45,000 S, 50,000 Cr, 6,000 Asphalt Block.
Orange, Kenneth Crane, Asst. E., 50,000 Wb, 13,000 Am, 8,800 Hasting Asphalt Block, 5,000 Cr, 1,475 Cs.
Plainfield, A. W. Vars, C. E., 7,500 Tc, 30,000 B, 20,000 M, 20,000 sq. ft. Cs.
Ridgefield Park, Rudolph Schweizer, Jr., V. E., 34,500 Tm, 18,250 A, 6,700 Cr.
Roosevelt, Fred F. Simons, B. E., 15,000 Cr, 50,000 sq. ft. Cs.
Roselle, J. L. Bauer, B. E., 10,000 Cr, 20,000 sq. ft. Cs.
Roselle Park, I. Wallace Higgins, B. E., 2,370 Tm, 38,130 Cr.
Rutherford, Robt. M. Watson, B. E., ½ Am, 3 Tm, 1 Cs.
South Orange, Ira T. Redfern, E., 4,000 Cr, 6,000 Asphalt Block.
Westfield, Edward Masher, T. E., 17,000 C, 20,000 M.
West New York, Carl Guisback, T. E., 8,000 Wb, 1,200 S.

NEW YORK:
Albany, W. P. Graham, C. E., 10,000 Sa, 3,000 Ac, 35,000 S, 2,000 C.
Binghamton, W. Earl Weller, C. E., 5,800 Ac.
Buffalo, C. E. P. Babcock, 1st Asst. E., 295,000 Sa, 10,500 S, 6,000 B, 2,800 Wd, 150,000 sq. ft. Cs.
Corning, Wm. O. Drake, C. E., 19,890 B, 14,630 Cr.
Endicott, C. R. Hunt, V. E., 1½ Wb, 13,600 B.
Geneva, J. W. Brennan, C. E., 15,000 Sa, 15,000 Wb, 15,000 B, 15,000 Cr.
Glens Falls, Ernest L. H. Meyer, C. E., 1,400 B, 20,000 Cs.
Haverstraw, W. A. Welch, C. E., 8,000 Am, 500 Cs.
Herkimer, C. Leland Wood, C. E., 9,000 Cr, 4,000 G, 3,000 sq. ft. Cs.
Hudson Falls, P. C. Richards, V. E., 4,200 C, 10,000 sq. ft. Cs.
Jamestown, E. C. Dollard, C. E., 30,000 B.
Lackawanna, F. C. Strack, Jr., E., 1.3 Cr, 4.7 M, 2.5 Cs.
Little Falls, Silas S. Feeter, C. E., 13,000 Cr.
New York City, Brooklyn, H. H. Smith, Ch. E., 432,000 Sa, 7,000 Am, 250,000 Cs.
Manhattan, Queens, Fred H. Shepheard, A-st. E., 100,000 Sa, 300,000 Ac, 250,000 Am, 25,000 S, 15,000 Ed, 35,000 M.
Niagara Falls, 13,378 C, 107,207 various.
N. Tonawanda, Carl L. Oelkers, C. E., 38,500 Wb, 200 Cr.
Ogdensburg, Geo. A. Tate, C. E., 10,000 Cr, 6,000 to 10,000 M.
Olean, E. E. Allen, C. E., 3.74 B, .23 Cr.
Oneonta, Frank M. Gurney, C. E., ½ G, 3,000 Cs.
Plattsburgh, N. J. Langlois, C. E., 6,000 Cs.
Port Chester, Chester A. Studwell, V. E., 1,800 S, 1,000 Cr, 5,400 C, 60,000 Cs, 35,000 Asphalt Block.
Poughkeepsie, Thos F. Lawlor, Sp. P. W., 6,300 Am, 25,600 Cr.
Salamanca, C. C. Cheney, C. E., 25,000 G, 30,000 Cs.
Schenectady, Geo. I. Howard, C. E., 33,500 Cr.
Watertown, P. B. Sutton, C. E., 5,300 C.
Watkins, Chas. E. Dennis, Sp. P. W., 1 G.

NORTH CAROLINA:
Asheville, B. M. Lee, C. E., 55,600 S, 10,135 C, 7,000 Cs.
Durham, H. W. Kueffuer, C. E., 15,000 Sa, 1,200 Durax, 500 B, 6,000 Cs.
Fayetteville, E. C. Derby, C. E., 10,000 Am, 10,000 Cs.
Greensboro, M. M. Boyles, C. P. W., 3 Wb, 2 C, 12 Cs.
Monroe, C. W. Lee, Supt. Water and Light, 1 Ac.
Statesville, R. L. Greenlee, C. E., 14,300 Sa, 7,200 Ac, 10,000 Cs.
Washington, P. C. Painter, C. E., 30,000 Sa, 65,000 B, 20,000 Cs.
Wilson, Gladding & Morrison, Con. E., 75,000 Wb.

NORTH DAKOTA:
Fargo, W. B. Stevenson, 20,000 Wb, 15,000 Cr.
Minot, E. J. Thomas, C. E., 10,000 Wb, ½ G.
Valley City, Jay W. Bliss, C. E., 17,000 G, 24,000 sq. ft. Cs.

OHIO:
Akron, E. A. Kemmler, H. E., 150,000 Sa, 10,000 Ac, 60,000 B, 2,000 Cr, 120,000 Cs.
Alliance, H. E. Anderson, C. E., 7,000 Ac, 45,000 B, 6,000 Cs.
Bucyrus, F. L. Niederheiser, C. C. E., 10,000 sq. ft. Tm, 13,000 B.
Chillicothe, H. M. Redd, C. E., 11,800 Am.
Columbus, R. H. Simpson, Ch. E., 5.8 Sa, .8 S, .6 B, 1.8 C.
Cuyahoga Falls, C. E. McKahan, C. E., 21,200 Sa, 4,800 B.
East Liverpool, J. N. George, Ch. C. E., 20,000 B, 12,000 Cr.
East Youngstown, H. E. Ruff, St. C., 4,000 ft. Cs.
Fremont, Geo. W. Lesher, C. C. E., 10,178 Sa.
Lancaster, Walter W. Fraf, 10,000 Sa, 18,000 B.
London, H. L. McCafferty, C. E., 53,000 B.
Lorain, Chalmers, C. Miller, C. E., 16,000 Sa, 17,000 Ac, 12,000 B, 15,000 Cr, 1,200 Cs.
Marion, Tom S. Cathers, C. E., 15,500 B.
Marysville, L. B. Harvey, C. E., 3,000 lin. ft. M, 2,000 lin. ft. Cs.
Middletown, W. C. Morrison, C. E., 69,192 sq. ft. Cs.
Niles, F. W. Ward, C. E., 15,000 B, 50,000 sq. ft. Cs.
Sidney, Thaleon Blake, C. E., 1 Cs.
South Point, G. C. Kinley, C. E., 1.58 Tm.
Troy, M. A. Gantz, Civ. E., 20,000 Cs.
Washington C. H., B. R. Jacobs, C. E., 20,000 Sa, 2,000 M, 1,000 lin. ft. Cs.
Wooster, C. O. Williamson, C. E., ¾ B.
Xenia, Kenyon Riddle, C. M., 30,000 Sa.
Zanesville, C. R. Spencer, C. E., 17,000 B.

OKLAHOMA:
Altus, Carl R. Reid, C. E., 2 Cs.
Bartlesville, E. D. Kirkpatrick, C. E., 12,490 C, 66,600 Cs.
Durant, D. C. Lipscomb, C. E., $200,000 C.
Enid, B. F. Lewis, C. E., 150,000 C, 10,000 Cs.
Hobart, C. H. Keiger, 30 blocks.
McAlister, Rose D. Ewens, C. Clk., 5 Cs.
Oklahoma City, B. M. Hart, C. E., 144,150 Sa.

Wagoner, H. H. Hellen, C. E., 1 G, 2,640 ft. Cs.

OREGON:
Bend, Robt. B. Gould, C. E., 58,200 W.
Dallas, Edw. J. Himes, E., 30,000 Ac or C.
Eugene, Harry E. Devereaux, C. E., 20,000 C, 4,000 G, 5 Cs.
Salem, H. M. Rogers, C. E., 20,000 C.

PENNSYLVANIA:
Altoona, F. D. Hain, C. E., 26,000 B, 3,000 Wd, 2,000 Cr.
Beaver Falls, Carl S. Donaldson, C. E., 11,000 Ac, 5,000 C.
Bowmanstown, W. N. Boyer, C. E., ½ Cr.
Bradford, B. A. Wise, C. E., 20,000 B.
Clearfield, E. W. Hess, E., 8,000 B, 1,000 Cs.
Corry, Nevin R. Dickson, C. E., 500 B, 3,000 Cs, 500 Brick Sidewalks.
Dickson City, R. E. Carter, B. E., 4,000 Cs, 3,000 Asphalt Block.
Dormont, E. O. Garrett, B. Sp., 10,000 ft. B.
Dorranceton, B. E., 17,000 Sa.
Duquesne, R. B. Dell, C. E., 16,905 C. 320 B.
East Bangor, H. C. Dilliard, B. E., 1,800 B, 12,000 Cr, 5,000 G, 1,150 Cs.
Easton, C. A. Reese, C. E., 600 A.
Ellwood City, Alex Main, B. E., 6,000 B.
Erie, Theodore Eichhorn, S. S., 160,000 Sa, 32,000 Cs.
Freeland, Theo. Reichmann, E., 10,000 A, 10,000 C, 4,000 G, 2,000 Cs.
Gallitzen, D. W. Dillman, B. E., 3,000 Cr.
Greenville, Chas. P. Clarke, B. E., 3,000 lin. ft. B.
Hanover, A. E. Kohr, B. E., 1,500 Sa, 10,000 M.
Harrisburg, M. B. Cowden, C. E., 66,000 Sa, 54,000 C or Sa.
Huntingdon, J. W. Oatis, B. E., 5,500 B.
Johnstown, H. Lee Wilson, C. E., 11,505 B, 4,257 Cr.
Lebanon, P. A. Volcker, C. E., 40,000 Cr, 100,000 Cs.
Mechanicsburg, Clark A. Bryan, B. E., 5,000 Am.
Norristown, S. Cameron Corson, B. E., 10,000 Tm, 2,500 A, 8,000 B.
Northampton, L. J. H. Grossart, T. E., 2,365 Cr, 650 Cs.
Philadelphia, Fred C. Dunlap, Ch., 25 Sa, 12 Am and Tm.
Pittsburgh, N. S. Sprague, Ch. E., 147,000 Sa, 18,000 Wb, 50,000 S, 7,000 B, 10,000 Cs, 1,000 Asphalt Block.
Pottsville, John H. Strauch, C. E., 11,000 B, 24,000 Wd.
Reading, E. B. Ulrich, C. E., 40,000 Sa, 5,000 B.
Sayre, Nathan F. Walker, B. E., 600 Cs.
Schuykill Haven, Geo. W. Butz, E., ½ Sa.
Scranton, Wm. A. Schunk, C. E.. 26,000 Sa, 2,000 S.
Sharon, Lewis E. Burnside, C. E., 6,300 Ac, 14,360 B, 5,000 Slag, 15,000 sq. ft. Cs.
Shipponsburg, T. L. Essick, C. E., 4,000 Cr.
Summit Hill, Roland H. Shinton, E., 3,500 Tm, 5,300 G, 4,000 sq. ft. Cs.
Uniontown, W. L. Dunn, C. E., 10,000 Tm.
West Homestead, C. Edward Long, Con. E., 13,000 B.
Wilkinsburg, Chas. F. Sperling, B. E., 5,000 B.
Woodlawn, M. B. Moore, B. E., 10,000 B.
York, C. F. Waller, C. E., 866 B.

RHODE ISLAND:
Newport, R. I. Easton, C. E., 32,879 Am, 400 M.

SOUTH CAROLINA:
Greenwood, B. R. Cowherd, Jr., Co. E., $50,000 Sa, $50,000 C.
Orangeburg, Edward Huwer, C. E., 65,000 Cs.
Spartanburg, J. H. Shores, S. S., 75,000 Ac.

SOUTH DAKOTA:
Aberdeen, Frank Le Cocq, C. E., 3 Cs.
Rapid City, T. H. Johnson, Con. E., Sioux City, Ia., 56,000 C.
Sioux Falls, S. B. Howe, C. E., 3,800 Cl 2 Cs.

TENNESSEE:
Clarksville, S. R. Alexander, C. E., 3 Ac.
Cleveland, S. D. Newton, C. E., 5,000 Sa, 30,000 Tm, 2,500 Cs.
Dyersburg, S. R. Blakeman, C. E., 10,000 Ac, 1,500 Cs.
Greenville, C. E. Coils, C. E., 4,000 Ac, 2,000 Am, 1,000 C, 100,000 M.

TEXAS:
Amarillo, H. B. Jones, C. E., $450,000 B, 6,000 ft. Cs.
Beaumont, O. A. Seward, Jr., C. E., $200,000 G, 150,000 sq. ft. Cs. $1,050,000 paving, type not yet selected.
Belton, H. R. Smith, Mayor, 8 Am, 12 G.
Bonham, Edgar Whedbee, C. E., 30,000 Tm.
Brenham, Wm. Luck, E., $150,000 C. Base and Uralde Asphalt topping.
Brownwood, Mark E. Ragsdale, C. E., 1,000 Cs.
Childress, R. C. Carraway Co., Con. E., 10,000 B.
Cisco, J. G. Reagan, Asst. C. E., 15,000 S, 3,000 Cr.
Clarksville, Paul Y. Creager, C. E., 300 C, 1,000 Cs.
Dallas, J. R. Graham, E., 150,000 Wb, 80,000 R, 10,000 G, 400,000 Cs.
Eastland, J. A. Wright, C. E., 35,000 Ac, 40,000 B, 5 Cs.
Galveston, Geo. H. Willits, 15,000 B, 15,000 Cr.
Greenville, A. D. Duck, E., 50,000 B.
Longview, H. N. Roberts, C. E., 2,000 Am, 10,000 B.
San Angelo, L. H. Laging, C. E., 8,000 G.
Temple, R. D. Morgan, C. E., 10,000 B, 2,500 C, 30,500 G, 20,000 sq. ft. Co.
Saco, H. R. Seword, C. E., 20 Tm, 25 G, 10 Cs.
Waxahachie, H. R. F. Helland, C. E., 6 Wb.
Weatherford, Geo. M. Parks, C. E., 7,000 W, 10 G.

UTAH:
Brigham City, H. C. Carver, C. E., 4,000 Wb, 4,000 C, 2,000 Cs.
Provo City, G. C. Swan, C. E., 27,500 C, 72,154.6 sq. ft. Cs.

VERMONT:
Barre, Sydney Lee Ruggles, C. E., $5,000 Cr.
Bennington, M. J. Burrington, Jr., Civ. E, 14,000 Cr.
Burlington, Thurman W. Dix, C. E., 1 Tm, 1,500 B, 1,600 Wd, ½ G, 3 Cs.
Rutland, Donald D. Snyder, C. P. W., 12,000 Cr.
St. Albans, J. H. Kennedy, Supt., 1 Tm.

VIRGINIA:
Charlottesville, W. Washabaugh, C. M., 6,000 C, 800 Cs.
Clifton Forge, E. C. Wisterman, Sp. P. W., 6,000 Am, 4,000 sq ft. M.
Danville, Ralph K. Lurville, C. E., 20,000 Sa, 41,331 Ac, 38,788 Am, 9,711 Durax or B.
Fredericksburg, L. Y. Houston, Jr., 20,000 G, 3,000 lin. ft. Cs.
Hampton, Girard Chambers, C. E., 3,000 G.
Newport News, E. Russell Davis, Civ. E., 11,874 Tm, 2,802 C.

WASHINGTON:
Aberdeen, A. H. Blood, C. E., 75,000 Cr, 15,000 Cs.
Dayton, Walker Range, C. E., 20,000 Wb.
Okanogan, Horace E. Smith, C. E., 47,459 M, 4,425 Cs.
Olympia, Ray R. Wood, C. E., 10,000 Sa, 2,000 B, 15,000 Cs.
Raymond, Louis D. Kelsey, C. E., 20,000 Cr, 20,000 C, 8,000 Cs.
Spokane, A. D. Butler, C. E., 30,000 Tc, 60,000 C, 10,000 Cs.

WEST VIRGINIA:
Clarksburg, J. R. Wilson, 6 Wb, 3 B, 4 C.
Fairmont, S. B. Miller, C. E., 2,000 Am, 6,000 B, 1,000 C.
Moundsville, Alex Purdy, 2,100 B.
Parkersburg, L. G. Merrill, C. E., 14,230 Sa, 6,370 B, 10,175 Cr, 4,750 C.
Princeton, Elmer C. Barton, Co. E., 4,000 Bit. M.

WISCONSIN:
Ashland, Jas. Phillips, C. E., 40,000 Bg, 4,500 C, 1½ Cs.
Augusta, Henry Olk, Con. E., 5,000 B, 10,000 Cs.
Beloit, G. E. Heebink, C. E., 2,000 Cs.
Eau Claire, J. T. Hurd, C. E., 6,000 Cr.
Edgerton, W. F. Reichardt, C. E., 30,000 Cr.
Janesville, C. V. Kerch, C. E., 2,000 Sa, 4,700 B.
Jefferson, E. B. Parsons, 10,000 Cr.
Kaukauna, Frank M. Charlesworth, Jr., C. E., 24,000 Tm, 20,350 Cr, 5,400 Cs.
Kenosha, P. J. Hurtgen, C. P. W., 40,000 sq. ft. Cs.
Madison, E. E. Parker, C. E., 2 Sa, .33 Wd, 1.00 Cr.
Manitowoc, F. L. Alter, C. E., 50,000 Cr.
Marinette, A. L. Hillis, C. E., $25,000 Tm or B or Cr.
Menasha, A. E. McMahon, C. E., 9,600 Cr.
Neenah, E. A. McMahon C. E., 14,000 Cr.
Oshkosh, G. H. Randall, C. E., 50,000 paving.
Port Angeles, R. J. Young, C. E., 10,000 C, 3,000 G, 5,000 Cs.
Rhinelander, J. G. Johnson, C. E., 5 Blocks M.
Sheboygan, C. U. Bolev, C. E., 40,000 Cr.
Superior, E. B. Banks, C. E., 24,420 Ac, 13,350 Am, 50,000 Cr, 150,000 sq. ft. Cs.
Wausau, B. C. Gowen, C. E., 15,000 C, 5,000 ft. Cs.
Wausau, B. C. Gowen, C. E., 15,000 C, 5,000 ft. Cr.
West Allis, E. G. Orbert, Chn. Bd. P. W., 30,000 to 40,000 Sa or Cr.
Wisconsin Rapids, E. H. Aldrich, C. E., 1,700 B, 19,700 Cr, 22,900 C.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems different will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Concrete a 2 on 1 Slope with a Slab Lining Having Few Joints

Deliver concrete continuously through chute, place it in alternate panels and anchor reinforcement if necessary to prevent slipping.

DEPARTMENT OF PUBLIC AFFAIRS
* * *, Texas,
March 10, 1921.

Editor, PUBLIC WORKS,
New York City.

SIR: In pursuance of your invitation to readers of PUBLIC WORKS to submit questions regarding construction problems, I wish to request you to advise me as to satisfactory methods for placing a 5-inch concrete lining on two-on-one slopes of an earth embankment, the slopes being about 35 feet in length. It is very desirable to have as few joints in the lining as possible; hence, it is planned to make a continuous slab in each day's work. The concrete will be delivered at the top of the slopes in wheelbarrows. The principal problems are to place the concrete fairly rapidly, spread it uniformly, prevent it from sliding down or sloughing off, and to finish it smoothly but without a troweled surface. Only common labor is available and no special equipment is on hand.

As it will probably take several weeks to have this matter published in your journal, and as we will soon be up to this work, I would appreciate very highly having an advance outline of your suggestions by letter.

Thanking you in advance, I am,

Yours very truly,
* * * * *
City Engineer.

You omit to mention the character of the sub-grade on which the concrete is to be laid, an important consideration that may influence the manner in which the work should be done and the success that can be attained. It should also be stated whether the concrete lining is required to be water tight at the joints.

Assuming that the surface of the sub-grade is hard, uniform and accurately dressed to the slope of the finished slab, the first essentials for the successful execution of the work as required will be the continuous delivery, in sufficient quantities, of a perfectly uniform concrete of suitable proportions and consistency and placing it in position by careful, skilful men under constant supervision of a competent engineer or inspector who should be very exacting.

PREPARATION OF SLOPE

The slope of the embankment should be thoroughly rolled or otherwise compacted and accurately dressed to the required surface. Care should be taken that the surface is not slippery and if necessary it should be finished with a thin layer of fine broken stone, gravel or coarse sand mixture well worked in and compacted. If there is a tendency for the concrete to slip down on the sub-grade it may be wholly or partly relieved by rolling the finished sub-grade on horizontal lines with a slightly corrugated or grooved roller, scoring the surface or making slight ribs thereon to engage the plastic concrete.

There should be built in advance a concrete stop wall at the bottom of the slope and parallel to it to receive the thrust from the lower edge of the concrete slab.

Wood or steel forms as high as the thickness of the slab should be set parallel with each other and from 6 to 12 feet apart extending perpendicularly to the thrust wall, from it to the top of the slope, dividing the slope into panels which should be alternately concreted.

DELIVERING CONCRETE

Close to the top and to the bottom edge of slope there should be laid a single or double-rail track parallel to the wall, the lower track being, if desirable, located on top of the wall. On each track there should be a pair of wheels or a truck supporting one end of an inclined chute for delivering the concrete from the wheelbarrows on top to different parts of the slope. A wheelbarrow runway should be constructed on the top of the slope and adjacent to it for the delivery of the concrete from the central mixing plant and provision should be made for the return of the wheelbarrows without interrupting their constant delivery.

At the upper end the chute should have a hopper for the most rapid and convenient dumping of the wheelbarrows into it. The chute should be parallel with the slope and only a few inches above it, and the lower end should be 2 feet or more clear of the top of the thrust wall. Stop boards and bottom or side gates should be provided at intervals along the length of the chute to permit the delivery of the concrete at any intermediate point between the bottom and the top of the slope.

Any available steel or wooden chute could be used, but it would probably be necessary to

strengthen it to enable it to span the 35-foot length of the slope. If the chute is already trussed, as is often the case with steel chutes provided for use on spouting jobs, the trusses probably project so far below the bottom of the chute that special supports must be provided at top and bottom to raise the truss clear of the concrete slabs. These may make it inconvenient to fill the chute from the wheelbarrow and to deliver the concrete satisfactorily at the lower end, where an additional length may be required to convey the concrete close to the sub-grade.

The chutes can be supported at any elevation between a pair of simple wood, steel, or combination beams or trusses that can easily be made at the site. Timbers, I-beams or channels will serve for the chord members and may be king-post or queen-post trussed with single full length rods bent in the middle and having nuts at the ends engaging beveled bearings at the chords. At the bends they should be supported on saddles or short posts attached to the lower sides of the beams. Light wooden trusses can easily be made with pairs of single 2 x 4-inch or any convenient size spaced for the top and bottom chords from 12 to 24 inches apart and connected by transverse and zig-zag pieces nailed on. If light deep I-beams or channels of sufficient lengths are available they will serve without trussing but are heavier than trussed members.

CONCRETING IN ALTERNATE SECTIONS

The forms should be rigidly fastened in position with the upper edges exactly in the required plane of the surface of the finished concrete. The chute should be set on the center line of the panel between two successive forms and concrete delivered to it as nearly continuously as possible. The fresh concrete should be delivered at the bottom of the slope and raked into position and to required uniform thickness, building on the upper edge and making the slab continuous from the bottom to the top, the concrete being discharged successively at different parts of the chute as the concrete advances toward the top.

The concrete should be of a rich mixture made with quick setting cement and rather coarse broken stone with finer material and sand very carefully proportioned by experiment to secure the utmost density, eliminate voids and consequently secure imperviousness. It should be mixed with a small percentage of hydrated lime and with as little water as possible to thoroughly wet the cement and aggregate and give a mixture neither sloppy nor crumbly but which will flush water to the top with moderate ramming.

As fast as the concrete is placed it should be screeded off by a straightedge operated on the upper edges of the forms; it should be thoroughly compacted from the bottom up by ramming, tamping or rolling.

REINFORCEMENT ANCHORAGE

If it is laid in this manner and there is still developed a tendency to slip or slough, it may be helped by the use of steel fabric reinforcement in full width strips extending from bottom to top of the slope and temporarily anchored securely at the top. When reinforcement is used, the concrete should be placed in two courses, both of them well tamped; after the first course is laid the reinforcement should be spread over it. Short transverse pieces of steel may be stuck half way through and perpendicular to it at frequent intervals to anchor with both courses of concrete and prevent it from slipping down.

After the top course has been screeded and tamped, it may be finished by a belt, the operation being the same as in highway pavement construction. Any available rubber or canvas belt can be used. It is convenient to attach it to both ends of a long thin board sprung to the arc of a circle of which the belt forms the chord. Handles at each end should be placed at a suitable angle for the most convenient operation of the belt, it should be moved back and forth at a slight angle until the desired finish is secured, working up the slope.

It is most convenient to concrete alternate panels of the slope and as soon as these are finished cover the surface with light working platforms to protect them and permit men to walk around freely on them while concreting the intermediate spaces. In this case the side forms should not be removed until after the concrete is placed between them and care should be taken that the concrete is tamped well against the edges of the existing slabs before the concrete in the intermediate panels is screeded by straightedges working on the first pair of slabs. In this way the intermediate slabs should be concreted before the first slab has set and the concrete can be made practically monolithic for a day's run or if the work is carried on continuously it can be monolithic throughout. The use of two chutes enabling the pair of panels to be simultaneously concreted will reduce the plan of grading between the alternate or intermediate slabs and tend to secure much better bond between them.

The concreting of a steep slope 100 feet wide is described in a paper by V. L. Sullivan, published in the transactions of the American Society of Civil Engineers, May, 1918.

Blasting Down Trees

When a tree is cut down and the stump subsequently blasted splinters are likely to fly that may damage adjacent property.

It is, however, a fact that splinters seldom fly from standing timber, therefore this danger can easily be avoided by blasting down the tree and blasting out the stump at the same operation. A successful example of this was afforded by the removal of nine pine trees, averaging 15 inches in diameter, at Rosemary, N. C. Bore holes were put in on opposite sides of each tree and in each hole there was placed a pound of 40 per cent ammonia dynamite and both charges were fired simultaneously with electric caps and a blasting machine. Ropes tied to the trees about 20 feet above the ground determined the direction of fall, and the trees were brought down, removed from the site and the ground ready for plowing in 10 hours at a cost of $16.

Recent Legal Decisions

CONTRIBUTORY NEGLIGENCE IN DRIVING UNDER OVERHEAD BRIDGE

A farmer bringing a load of hay to market in a city, while sitting on the top of the load undertook to drive under an overhead railway bridge. There was not sufficient room to do so and he was struck by the underside of the bridge, sustaining serious injuries, for which he sued the city and the railroad company. The bridge had been there for many years, the plaintiff was familiar with it, and there was nothing to distract his attention. Reviewing at length the evidence and prior decisions, the Michigan Supreme Court holds, Falchee v. City of Jackson, 180 N. W. 507, that the plaintiff was guilty of contributory negligence, as a matter of law. He saw the bridge and if he had observed he would have known he could not pass under it safely; and if he had alighted and driven his team he would have avoided all danger.

DAMAGES FOR WRONGFULLY CUTTING OFF WATER

In an action again a waterworks company for wrongfully cutting off the plaintiff's water service the jury were instructed that the latter could recover "for the injury sustained, that is to say, humiliation, embarrassment, annoyance and inconvenience," to which the defendant excepted. The Alabama Supreme Court holds, Birmingham Waterworks Co. v. Justice, 86 So. 389, that an instruction, in a case like this, that a plaintiff could recover for "inconvenience" and "annoyance" caused by breach of the contract to supply him with water is not improper, so that the defendants' exception not being restricted to that part of the instruction authorizing a recovery for "humiliation" or "embarrassment" was bad, whatever might have been its merit if so restricted. The inference apparently is that no recovery could be had for humiliation or embarrassment.

CITY OWNING WATERWORKS AND FURNISHING WATER DOES NOT IMPLIEDLY WARRANT ITS WHOLESOMENESS

In an action against a city by a citizen for breach of alleged implied warranty that the water supplied by the city for domestic consumption is pure, wholesome and fit and proper for human consumption and for drinking purposes and free from poison and disease-breeding germs, the question was whether or not a warranty was so created.

While the business of maintaining a municipal water system and supplying water to private consumers at fixed compensation is public in its nature and impressed with a public interest it is not an exercise of governmental or police power. The court cited many decisions and text writers to the proposition that a private water company or a municipality is not an insurer nor liable as a guarantor of the quality of the water it furnishes to its customers in the customary means of pipes and faucets, and cannot be held liable for injuries caused by impure water furnished by it unless it knew or ought to have known of the impurity. Its duty is that of exercising reasonable and commensurate care and diligence in providing an adequate supply of wholesome water at all times.

New York Personal Property Law, § 96, provides that there is no implied warranty as to the quality or fitness for any special purpose of goods sold, with certain exceptions, one of which is where the buyer, expressly or impliedly, makes known to the seller the particular purpose for which the goods are required and apparently relies on the seller's skill or judgment. The furnishing of water, through a system of waterworks, by a water corporation, either private or municipal, to private consumers, at a fixed compensation, is held to be a sale of goods within the meaning of the statute. But it is also held that a taker of water from such a system does not by the mere taking make known, either expressly or impliedly, to the seller the particular purpose for which the water is required, and cause it to appear that he relies as to the wholesomeness of the water on the seller's skill and judgment. It is a matter of common knowledge that human skill or judgment cannot increasingly and under all conditions and circumstances see to it that no unwholesome water is furnished. It is also a matter of common knowledge that a company or municipality does not know that any particular use is to be made of any particular portion taken. Of the water taken the part not used for drinking or human consumption is much the greater. It was also pointed out by the court that the possibilities of contamination are many and varied. There is no conceivable method by which the corporation can absolutely secure and maintain to the water wholesomeness and freedom for pollution. There is no method of analysis or inspection by which the corporation can with certainty furnish and know that it is furnishing no other than wholesome water. For these reasons it was held the plaintiff's complaint stated no cause of action; three of the seven judges dissenting. Canavan v. City of Mechanicville, New York Court of Appeals, 128 N. E. 882.

LIMITED AUTHORITY OF MEMBERS OF BOARDS OF PUBLIC WORKS

A city having been sued and compelled to pay a pedestrian for damages sustained by falling over an obstruction consisting of a cement step, 11 inches wide, leading into the business room of a resident and placed there by him, sued the resident to recover the amount of the judgment. It was held, Sipe v. City of Kokomo, Indiana Appellate Court, 129 N. E. 61, that the fact that a member of the board of public works of the city, out of the presence and hearing of the other members of the board, told the defendant that he might build the step, could not protect the defendant from liability; since Section 8694, Burns' R. S., Ind., 1914, expressly provides that no member of such a board shall have any authority to act on behalf of the board except pursuant to an order thereof regularly made at a meeting at which a majority of the board shall have been present.

NEWS OF THE SOCIETIES

April 11 — HARTFORD SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. City Club, Hartford, Conn.

April 14—SAN FRANCISCO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

April 15 — MERIDEN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

April 16—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Joint meeting with the Association of Iron and Steel Electrical Engineers. Pittsburgh, Pa.

April 18-23 — UNITED STATES GOOD ROADS ASSOCIATION. Greensboro, N. C.

April 21-22—BANKHEAD NATIONAL HIGHWAY ASSOCIATION. 5th annual convention. Greensboro, N. C. Secretary, J. A. Routree, Birmingham, Ala.

April 22 — METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with American Institute of Electrical Engineers.

April 22—BIRMINGHAM SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Atlanta, Birmingham and New Orleans sections, with members of Council present. Battle House, Mobile, Ala.

April 27—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention. Houston, Texas.

April 27-29—UNITED STATES CHAMBER OF COMMERCE. 9th annual meeting. Atlantic City, N. J.

April 27-29 — BUILDING OFFICIAL'S CONFERENCE. Seventh annual meeting. Cleveland, Ohio.

April 28-29—MID-CONTINENT SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting of Chemical Eng. Societies. City Auditorium or Convention Hall, Tulsa, Okla.

April 29 — EASTERN NEW YORK SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Edison Club Hall, Schenectady.

April 29 — COLORADO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Metropole Hotel.

May 2-4—MISSISSIPPI VALLEY ASSOCIATION. 3d annual convention. New Orleans, La.

May 4-7—NATIONAL FOREIGN TRADE CONVENTION. 8th convention. Cleveland, Ohio.

May 9-11—AMERICAN ASSOCIATION OF ENGINEERS. 7th annual convention. Buffalo.

May 9-12—SOUTHWEST WATER WORKS ASSOCIATION. Shirvin Hotel Headquarters, Oklahoma City, Okla.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

May 19 — SAN FRANCISCO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

May 20 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. 370th meeting. Engineering Societies Building, New York City.

May 23-26 — AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting. Congress Hotel, Chicago.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June 21-24 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual and Pacific Coast Convention. Salt Lake City.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The topic of discussion at the March 2 meeting of the American Society of Civil Engineers, held in New York, was the report of the New York-New Jersey Port and Harbor Development Commission. B. F. Cresson, Jr., opened the subject by presenting the report of the committee, whose plan is to make the harbor a railhead port, with the exception of Manhattan, where local distribution and collection of freight would be conducted through a dozen or so zone-warehouse terminals served by a deep tunnel, with two tunnels under the Hudson River, connecting with a joint transfer yard in Hackensack Meadow, New Jersey. Those joining in the discussion were T. Kennard Thomson, Gustav Lindenthal, B. F. Fitch, J. P. Hallihan and G. W. Kittredge, who closed it by urging the support of the society in developing relief for the port of New York.

NORTH DAKOTA SOCIETY OF ENGINEERS

At its annual meeting on February 10-11, the North Dakota Society of Engineers elected the following officers: President, R. N. Stee; first vice-president, E. R. Griffin; second vice-president, W. B. Stevenson; and secretary, E. F. Chandler.

AMERICAN ASSOCIATION OF ENGINEERS

A committee of thirteen prominent members appointed to recommend standard for practical engineers have made a progress report giving tentative schedule for hydraulic, sanitary, municipal and structural work and recommends the preparation of similar schedules for mechanical, electrical, chemical and other services and regular services. The special services defined include: Consultation, arbitration, professional advice, expert testimony, valuations and appraisals, service and efficiency tests and reports.

Regular engineering services include: Reconnaissances, surveys of all kinds, borings, soundings, tests, experimental work and a compilation of all data necessary for the preparation of (a) preliminary reports, (b) preliminary estimates of costs, and (c) plans and specifications. Necessary conferences, preparation of preliminary plans, estimates, and reports covering all features of the work with various alternate plans and recommendation for a solution of the particular problem. Preparation and presentation of working plans, profiles, specifications and estimates for letting of contracts or purchase of material and machinery and for complete information of client or owner.

Attendance and advice at meetings, resident supervision of construction continuously "on the ground," purchase of all materials, equipment and machinery, complete management of project from inception to completion, but not financing. Charges for all classes of "special" work may be placed on a per diem basis and should vary according to the character of the work, its magnitude and importance. The charge should vary from $50 a day upwards. Retainer fees may also be properly charged. Additional charges should also be made for all actual expenses such as traveling and general office expense. Instead of the per diem charge as set forth in the schedule a fixed total sum may be agreed upon. For "regular" services charges may be made on a percentage basis.

NEW YORK SECTION, AMERICAN WATER WORKS ASSOCIATION

At the reorganization meeting of the board of governors of the New York Section, A. W. W. A., held March 2, the following officers were elected: President, George A. Johnson; secretary, Burt B. Hodgman; and directors, Edward S. Cole, Charles R. Bettes and D. W. French. It was decided to hold the section meetings on Friday afternoons instead of Wednesdays from now on, particularly for the convenience of out-of-town members.

NATIONAL BOARD OF JURISDICTIONAL AWARDS

At the spring meeting of the board the representatives of the engineers, architects, employers and contractors and all but one of the international trades unions pledged acceptance of the board's awards. The president of the carpenters alone refused and his resignation from the board was immediately accepted.

The new agreements between the Building Trades Employers and the Building Trades Councils of St. Louis and of Chicago provide that there shall be no stoppage of work because of jurisdictional disputes. The awards made by the National Board of Jurisdictional Awards shall be enforced by the Building Trades Council of St. Louis. Cases not covered by awards of the National Board are to be adjusted by the St. Louis Building Trades Council.

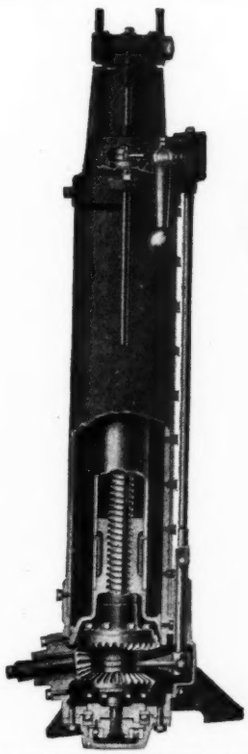
CHAMBER OF COMMERCE OF THE UNITED STATES

The general theme of the ninth annual meeting of the Chamber of Commerce of the United States, to be held at Atlantic City April 27 to 29 will be: "In the public interest more business methods in government; less government management of business." On the day before the convention opens there will be a meeting of the National Council of the Chamber, made up of one representative from each of the more than 1,400 organizations included within the Chamber's membership.

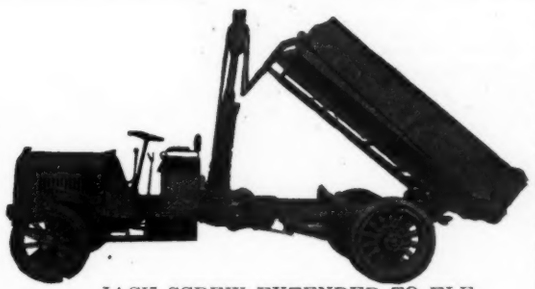
In the first day of group meetings, the group representing Domestic Distribution will discuss current price declines and their effects. Treatment of wages, contract cancellations, better accounting methods and the need of national statistics on production will be taken up by the group representing Fabricated Production. Transportation and communication will be considered under two groups, the first having to do with shipping, and the second, railroad transportation.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



JACK SCREW OPERATED BY BEVEL GEAR



JACK SCREW EXTENDED TO ELEVATE DUMP BODY

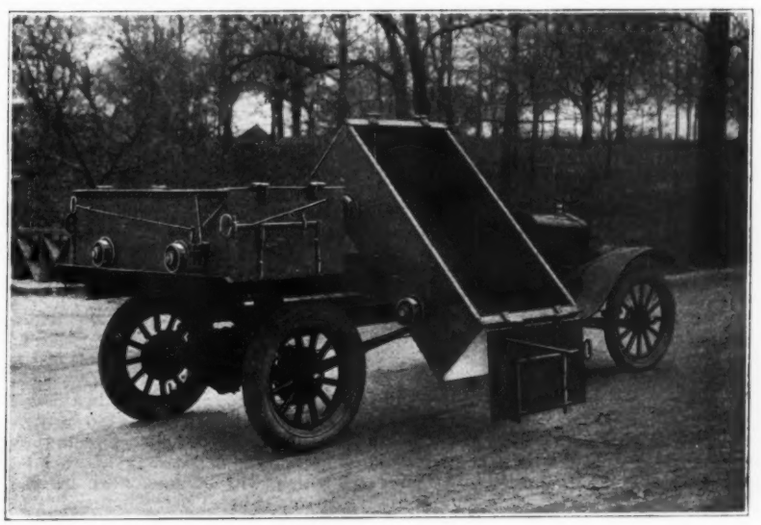
VAN DORN DUMP TRUCK BODY HOIST

The dump truck body hoist manufactured by the Van Dorn Iron Works Company is a sturdy compact attachment operating on the screw jack principal that consists of a vertical telescopic cylinder and piston installed on the truck chassis behind the driver's seat.

It is operated by bevel gears from the truck engine and is controlled from the driver's seat by a hand lever operating a 4-jaw clutch that revolves the jackscrew and lifts the end of the truck body through ⅝-inch steel cables, thus utilizing the otherwise wasted power of the engine that is ordinarily left running while the truck is being dumped.

The hoist is designed to easily dump a 6-ton load in 20 seconds at a moderate engine speed. After the body is elevated to the maximum angle of 45 degrees the hoist automatically stops and locks itself until released by hand control, thus making it safe to go under the elevated body to repair the truck if necessary. The device is self-lubricating and so durable that it will outlast several trucks. It is made with four vertical and four inclined bodies, with total height of 59 to 66 inches and widths of 14 inches and 19 inches.

Van Dorn steel dump truck bodies are made of every type for every cargo. Standard bodies of 2, 3, 4 and 5 yards capacity weigh from 900 to 1,750 pounds.



ROLLER BEARING SIDE DUMPING DUPLEX BOXES

GAMMON DUMP BODY

The Gammon side-dump body manufactured by the Pechstein Iron Works was invented by a contractor who had several built for use on road construction work where they reduced transportation cost so much that it was decided to put them on the market.

Each truck is equipped with a pair of steel boxes with four wheels running on tracks transverse to the special truck frame that supports them. They are provided at each end with a gate hinged on the upper edge, and when rolled to one side or the other, dump by gravity on either side of the truck.

The inside dimensions of the boxes are 60 x 30 inches x 18 inches deep, and they weigh 578 pounds each.

They require no gears or small hoists, are perfectly balanced and can be unloaded in less than two minutes. They are mounted on a special structural steel frame and can be installed on the truck chassis in 30 minutes.

EXCAVATING AND EARTH HANDLING MACHINERY

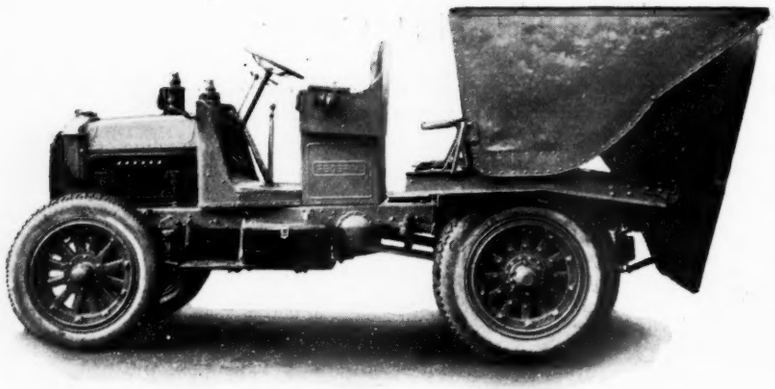
The Cable Excavator Company has issued an illustrated catalog chiefly devoted to a description of the Hadfel Black cable excavators for general excavating work, such as canals, railroads, quarries, sand and gravel washing, screening and loading, sewer and irrigation work, dredging, loading and unloading barges and the like.

The Type A cable excavator has a capacity of 200 to 2,000 yards per day and is operated by three men. Its traveler is movable in a lateral direction, normal to the line of the main cable, and the mast is easily arranged to tilt to the right or left to correspond with changes in the center line of digging. The Type B cable excavator has a bucket supported between two parallel carrying or trolley cables permitting its use where only low towers and small cable deflections are possible.

The Type D cable excavator is most frequently sold and is the most compact, efficient and economical plant for digging sand and gravel from level deposit and delivering it crushed, screened and washed at the foot of the tower ready for shipment. Ordinarily the terminal of this plant is placed on a turntable permitting the excavation to be prosecuted in any direction by merely changing the anchorage at the lower end of the cable. The engine and all other operating mechanism are located on the turntable at a considerable elevation, enabling it to work above adjacent buildings, roadways, etc. The spans range from 200 to 1,200 feet and capacities from 300 to 3,000 tons per day. The plant is operated by only one man.

A number of illustrations show the cableways used for excavating, washing and screening sand and gravel, for stripping overburden, for making concrete piles, for distributing and placing concrete and for digging clay and gravel.

The catalog also illustrates and describes the Parrish flexible arm scraper, cylindrical revolving sand and gravel screens, rock crushers of several sizes, bucket elevators, rock drills, and steel rope fixtures.



2½-TON TRUCK CHASSIS WITH TWO ROLLING DUMP BUCKETS

FEDERAL ROAD BUILDING TRUCK

The road building truck manufactured by the Federal Motor Truck Company has a special 2½-ton chassis equipped with two batch gravity dump buckets for handling wet or dry aggregate.

The buckets are locked in position for transportation and dumped by gravity by revolving around their curved bottom surfaces. It is claimed that a truck thus equipped can haul more batches per day than a 5-ton truck with a single large dumping body and does it at about one half the cost per ton mile of 1-ton trucks and one half the cost per square yard of pavement that is served by 1-ton single-batch haulers. On a given job the truck averaged 74.68 miles per day for one month, hauling the material at a cost of $0.2171 per ton-mile or $0.1495 per square yard of pavement.

INDUSTRIAL NOTES

The Hendricks Manufacturing Co., Carbondale, Pa., has opened a branch office at 915-916 Union Bank building, Pittsburgh, Pa.

Andrews, Tower & Lavalle, construction engineers, Springfield, Mass., have opened an office at 144 West 44th street, New York City.

O. H. Rundquist, Holger Jensen and Oscar Gullickson, of St. Paul, Minn., have incorporated under the name of the St. Paul Manufacturing Co., with headquarters at 1464 Shelby avenue, where they will deal in truck bodies and engage in general contracting business.

George J. Blanton, formerly associated with the General Electric Company and for four years connected with the Engineering Sales Department of the Chain Belt Co., Milwaukee, has been made New York district manager of the latter company.

C. A. Irwin, formerly president and general manager of the LaSalle Cement Co., has been elected vice-president of the Alpha Portland Cement Co., and will have charge of the interests in the territory formerly served by the Burt Portland Cement Co., Bellevue, Mich., the Ironton Portland Cement Co., Ironton, O., and the LaSalle Cement Co. at LaSalle, Ill., all of which companies have been taken over by the Alpha company with headquarters at 140 South Dearborn street, Chicago, Ill. Sales offices will also be continued at Bellevue, Mich., in charge of F. L. McClintock, district sales manager, and at Ironton, O., in charge of J. R. Paul, district sales manager.

The Locomotive Superheater Co., of 30 Church street, New York City, have opened their own company office at 382-388 Union Arcade building, Pittsburgh, Pa. Mr. John LeValley, formerly sales engineer at the Chicago office, has been appointed district manager.

The T. L. Smith Co., formerly of 470 Old Colony building, Chicago, has moved to 1125 32d street, Milwaukee, Wis. This move was made to bring about closer co-ordination between the sales and service departments, the latter of which will be in charge of R. E. S. Geare, general sales manager of the company.

The National Steel Fabric Co., Pittsburgh, Pa., has opened an office at Atlanta, Ga., in charge of H. S. Gibboney, district manager, 604 Walton building.

Homer Niesz has been appointed manager of Industrial Relations of the Commonwealth Edison Co.

National Steel Fabric Company has opened a sales office in the Mutual building, Kansas City, Mo., in charge of H. H. Robinson.

STEEL FORMS

The complete line of steel forms for road, sidewalk, curb, gutter, walls, culvert and post construction, manufactured by the Hotchkiss Metal Products Co., Binghamton, N. Y., will be taken over by the Lakewood Engineering Co.

S. D. Inman has been placed in charge of the engineering and design of the American trolley carrier, monorail conveying equipment for handling bulky materials from railway car to pile, bin or bunker, of the Conveyors Corporation of America.

FRASER, BRACE & CO.

This company of contracting engineers for pulp and paper mills, industrial plants, heavy building foundations, bridge piers, docks, dams, tunnels, hydro-electric construction, mine shafts, shoring and underpinning, announce the removal of their offices to their own building at 32 Pearl street, New York City.

PERSONALS

Petterson, V. S., assistant city engineer of Chicago, has resumed his former duties as chief efficiency engineer in the office of the city comptroller.

Thurman, C. O., of Washington, D. C., has been elected borough engineer of Jersey Shore, Pa.

Baxley, Franklin, has been appointed engineer in charge of the municipal plants of Bellefontaine, Ohio.

Morisette, H. L., has been appointed assistant engineer of the United States Reclamation Service at Yakima, Wash.

Moore, George H., has been made senior electrical engineer of the Public Service Commission of the state of Washington, with headquarters at Olympia.

Osgood, George W., has been appointed manager, as well as chief engineer, for the port of Tacoma.

Caton, John H., 3d, has been appointed director general of public works in Santo Domingo, with headquarters at Santo Domingo City, R. D.

Henderson, W. S., formerly county engineer of Washington county, Kansas, is to become city engineer of Lawrence, Kansas.

Fredendagen, V. B., has been appointed county engineer of Jewell county, Kansas, with headquarters at Mankato.

Dean, M. L., has been appointed consulting engineer for the new road program to be carried out by Walla Walla county, Wash.

Tompkins, Calvin, formerly commissioner of docks and ferries of the city of New York, died in New York on March 13.

Brenton, William H., field engineer for the Interstate Commerce Commission in the Pacific district, died recently at Jerome, Ariz.

J. C. Witt, formerly with the University of Pittsburgh, School of Chemistry, is now chief research chemist, with the Portland Cement Association, located at 1951 West Madison avenue, Chicago.

J. H. Libberton, formerly manager of the Service Bureau, Universal Portland Cement Co., is now with the General Chemical Co., at its offices, 25 Broad street, New York City.

B. J. Latimer has resigned as chief engineer of the Southwestern Portland Cement Co., El Paso, Texas, and accepted the position of superintendent of the Nebraska Cement Co., Superior, Neb.

C. H. Mannion, formerly with the Columbia Sugar Co., Mt. Pleasant, Mich., has accepted a position as chief engineer of the Petoskey Portland Cement Co., Petoskey, Mich.

H. M. Hess, formerly chief chemist of the Monarch Cement Co., is now chief chemist of the Edmonton Portland Cement Co., Edmonton, Alberta, Can.

H. G. Loefler is now with the Monarch Cement Co., in charge of construction.

John Hall has recently been appointed chief chemist of the Monarch Cement Co.